MINISTÈRE DE L'AGRICULTURE

MINISTERIE VAN LANDBOUW

BULLETIN

DU

JARDIN BOTANIQUE DE L'ÉTAT

BRUXELLES

BULLETIN

VAN DE

RIJKSPLANTENTUIN

BRUSSEL

VOLUME JUBILAIRE
WALTER ROBYNS — XXVII

JUBILEUMDEEL
WALTER ROBYNS — XXVII

BRUXELLES
1957

BRUSSEL
1957

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Delectus seminum quae Hortus Botanicus Bruxellensis pro mutua commutatione offert. Anno 1957.

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(fascicule 1)
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RIJKSPLANTENTUIN

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WALTER ROBYNS — XXVII

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31 mars 1957

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31 maart 1957

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In honorem

Walter ROBYNS

XXV jam annos
(1931-1956)

HORTI BOTANICI BRUXELLENSIS
DIRECTORIS

Studia opusculaque
a collegis et amicis
grate dedicata

1957

Walter ROBYNS
Directeur du Jardin botanique de l'État (1931-1956).
Directeur van de Rijksplantentuin (1931-1956).

MINISTÈRE DE L'AGRICULTURE

CABINET
DU MINISTRE

Depuis le 1er novembre 1931, Monsieur le Professeur Walter Robyns préside aux destinées du Jardin botanique de l'État à Bruxelles.

Par l'accroissement considérable de ses collections, l'ampleur et la valeur de ses publications, notre Jardin botanique n'a cessé au cours de ce quart de siècle de prendre une place de plus en plus grande parmi les établissements du genre : il se classe ainsi parmi les premières institutions scientifiques mondiales.

Je souhaite à Monsieur le Directeur Robyns la joie de pouvoir dans un avenir

MINISTÈRE DE L'AGRICULTURE

CABINET
DU MINISTRE

la propriété, orienter tous les
termes dans le nouveau parc botanique
du Domaine de Bouchout.

Les Conservatoires actuellement en cours ou sur le
point d'être livrés en service dans ce Domaine
à l'occasion du jubilé de notre parc botanique,
et tous, nous serons pour notre Ministère de
l'Agriculture et pour notre pays, le plus
beau jardin botanique d'Europe : ce sera
incontestablement pour le Directeur Robyns
le couronnement d'une longue et fructueuse
carrière.

En préfaçant ce volume jubilaire, je partage la
joie de ses amis et je rends au Directeur W. Robyns
un hommage justement mérité.

[illegible]
Ministre de l'Agriculture.

Sedert 1 november 1931 wordt de leiding van de Rijksplantentuin te Brussel waargenomen door de heer Professor Walter ROBYNS.

Door de aanzienlijke aangroei van zijn verzamelingen, de omvang en de waarde van zijn publicaties, heeft onze Plantentuin niet opgehouden, in de loop van dit kwarteeuw, een steeds belangrijker plaats in te nemen onder de instellingen van dit soort : hij is aldus te rangschikken bij de eerste wetenschappelijke instellingen ter wereld.

Ik wens de heer Directeur ROBYNS de vreugde te genieten al zijn diensten, in een nabije toekomst, te kunnen concentreren in de nieuwe Plantentuin van het Domein van Boechout.

De bouwwerken die aan gang zijn of die op het punt staan aangevat te worden, zullen hem de gelegenheid geven om van onze Plantentuin — en wij zullen er voor ons Ministerie van Landbouw en voor ons land trots op zijn — de schoonste Plantentuin van Europa te maken : dit zal ontegensprekelijk voor de heer Directeur ROBYNS de bekroning zijn van een lange en vruchtbare loopbaan.

Door dit Jubileumboek in te leiden, deel ik in de vreugde van zijn vrienden en breng ik aan Directeur W. ROBYNS een welverdiende hulde.

R. LEFEBVRE,
Minister van Landbouw.

at least our own mistakes in order to avoid making more or less similar mistakes in the future. Nor are we here concerned with imperfections in classification due to incomplete data, such as poor or insufficient specimens, absence of relevant field notes, and the like, except in so far as rashness or caution in using incomplete data is, at least in part, a character of an individual subject. After all, it can be argued that the available data are rarely, if ever, all that one would wish.

If classifying be defined simply as a sorting into « classes » and classification as the result of such sorting, we come at once to a basic problem which is : are the « classes » made by the botanist or made or given by « nature » ? This is generalizing to include such queries as : is a species « real », is a species « natural » or « more natural » than a genus or family, and is a taxon, or to what degree is a taxon, artificial ? In order to start with arguments as clear and simple as possible let us concentrate for a paragraph on the taxonomic class « species » and to consider a given species, say *Ranunculus bulbosus* in conformity with the assumption in hundreds of floras that there is a species conveniently named *Ranunculus bulbosus*. It is impossible to avoid the conclusion that there is a double aspect for the taxonomist in considering *Ranunculus bulbosus*. First, he can say this species is the sum total or final population of all individuals having (or not having) the characters 1, 2, 3, 4,... More precise definition would be (1a) to say that by « individuals » is meant all plants now living and growing with these characters, thus excluding herbarium specimens and fossils or, alternatively, (1b) to include all individuals that are living or have ever lived with these characters or potentially capable of developing them. Ramets of clones would be included under physiologically independent individuals. Either of these subaspects is concrete in the sense of viewing the species as a mass or population of individuals, i.e. of objects amalgamated as a compound object. Secondly, there is the more abstract aspect when the taxonomist says the species *Ranunculus bulbosus* is a class into which any individual having (or not having) the characters (or potentialities for developing or not developing, the characters) 1, 2, 3, 4,... can be placed if such an individual exists or has existed or could be placed if it came into existence. Thus we have to consider *Ranunculus bulbosus* as a sum total of individuals (1a) existing or (1b) existing and having existed or (2) existing, possibly existing, having existed, and possibly going to exist. Even so, we may

emphasize either the individuals or the characters. The individuals (1) are given, or if one prefers one can say they are made by « nature », but the taxonomist at least selects his characters and, in a sense, makes the character combination he uses. Thus one can say the taxonomist decides on or makes the boundaries within which all individuals are *Ranunculus bulbosus*. It would appear that to this extent he makes the species but he does not make the individuals composing the species. He imposes boundaries within which certain objects are included and outside which others are excluded. The « species », to generalize beyond *Ranunculus bulbosus*, is abstract or artificial as to its boundaries, but given those boundaries is concrete or natural as to its contents.

So far as we have considered the matter, there seems no fundamental difference between varieties, species, genera, or families. Every taxon is both natural and artificial. However, classification theory is not quite so simple as this.

The botanist selects and relatively evaluates the characters he uses for delimiting taxonomic classes. He may select one character (more accurately one positive or one negative character with the opposite also existing), or few, or several, or many characters. If he selects one or a few he makes a special classification for a limited use, if he selects many the classification should have the wider use the more characters there are that can be correlated. Correlation, of course, includes recognition of gaps between classes. It is also not only the number but also the kind of characters used that needs consideration. A classification should have a wider use if, besides characters of gross morphology, those of anatomy, cytology, biochemistry, and genetical and physiological behaviour are also included. The more characters of all kinds that are included the more nearly will a classification approach a general classification. In practice, there are always temporary limits. Whether there are permanent and insuperable theoretical limits to a completely general classification is an interesting matter for speculation. All the limits known at present would appear to be such as can be overcome given time and money !

To the extent that taxonomists select and give values to (or weigh and weight) characters, classification has a subjective

(1) Difficulties in defining « individuals » are numerous in biology, but the subject requires a separate paper.

element. In selecting and evaluating, the taxonomist, of course, uses his common sense and his experience. These are personal and individual in that they vary from one taxonomist to another and depend in part on his inherent and genetically inherited qualities. They have, however, been modified by education and other environmental accidents. We will now consider some of the other subjective elements in botanical classifying.

Tradition has been defined as « opinion or belief or custom handed down ». We have, in plant taxonomy, more tradition than in most other branches of botany. This is not to say that tradition is always and necessarily an evil. Indeed, taxonomists can justify a high degree of conservatism. Taxonomy is not only a subject in its own right but is also a *sine qua non* for much research in all other divisions of botany, pure and applied. To change a much used classification may upset many workers and should not be done light-heartedly. This even applies to nomenclatural changes and foresters and horticulturists, for example, can legitimately complain of instability in the use of latin names of plants. Nevertheless, progress can be stayed or delayed by too servile a dependence or traditional methods and hypotheses. It is sometimes extremely difficult to break away from tradition. One knows that there is or was some valid foundation for a given tradition. It was based on experience, often on trial and error over a long period with serious consideration of results.

To discard tradition without having something better, and preferably much better, with which to replace it would lead to chaos. On the other hand tradition may be definitely out-of-date but owing to laziness or lack of courage the taxonomist shirks the labour or risk of making drastic changes. The taxonomist again and again, in small matters and in large ones, comes up against this subjective dilemma. He feels that some change from traditional procedure is desirable but he has to decide whether or not he has the time and the ability and can procure the factual data for such improvement as will fully justify the upsetting of an accepted classification. Quite often he compromises and « patches up » leaving fundamental changes for his successors.

The worst possible feature of tradition is that it may become so ingrained that it is accepted as self-evident truth. The pre-Darwinian dogma of the once-for-all creation of species was in this category. Taxonomists would now flatly repudiate this dogma but in practice it is still largely written into the methodology of

plant taxonomy. There is little or no scope in the International Rules of Botanical Nomenclature for dealing with taxa in the course of evolution — every plant or group must be placed in a neat, restricted, named pigeon-hole. No doubt there are « good » species and « bad » species but just as surely there are intermediates and subjectively on the basis of tradition they are not recognized as such but have to be relegated either to a pigeon-hole into which they do not fit well or to synonymy.

Under the general heading of tradition we have to note that in taxonomic botany, as in every other branch of science, we start with certain premises and axioms which we regard as « given » and therefore ignore. We accept those of logic and mathematics and it would probably ill-become most of us to question these in any way. There are, however, a number of axioms and premises within the province of biology, others in that of botany, and others in that of taxonomic botany. In the last, for example, we accept that classes can be made for plants, that classes can be made in sufficient numbers to accommodate all plants, that such classes can be accepted by all taxonomists, that we can differentiate the classes by the characters (or their absence) common to all plants placed in a class, and so on. It can be argued that these premises work in practice but such pragmatic proof is all we have to guarantee their truth. Whether they stand in their own right or whether we provide them for our own purposes remains questionable. Those who claim that their classification is based on phylogeny make many more *a priori* assumptions than they appear to recognize. For most groups of plants there is very little palaeobotanical evidence relevant to group phylogeny. It follows that phylogenetic speculation is based on classification, not classification on known phylogeny. The fundamental assumption of those who claim at least that classification and phylogeny (or possible phylogeny) can be correlated is that common characters prove common origin and the more numerous the common characters one class has with another the closer the common origin. This premise is seldom, if ever, fully and convincingly analyzed and its acceptance (or rejection) remains largely subjective.

Another subjective element infringing on plant taxonomy is language. This is common to all human mental activities. Language here means not « a language » but symbolization by means of words strung together in sentences, whether the words and the syntax are Latin, Greek, German, French, English, or so on. This

matter has been discussed at length by modern logical positivists and their offshoots. We are here concerned only with language as a subjective element in the practice of plant taxonomy. Generally speaking scientific jargon is more precise in usage than everyday language — even when words are the same in each. Nevertheless there are many terms whose meaning is not fixed. The result of this is easily demonstrated by comparing the descriptions of leaf shape for some species with simple leaves, such as *Salix alba* or *Bellis perennis,* in half-a-dozen recent floras. Alternatively, if one looks up the definition of such a term as « lanceolate » in as many glossaries the results will probably be disturbing. It would, of course, be no more difficult to prepare and have accepted an International Glossary of Botanical Terminology than an International Code of Botanical Nomenclature but it has not been done. There is no doubt that at present taxonomists have their own private standards for the use of many technical terms, that some of these are used with a surprising elasticity of meaning, and others are precised sometimes in one way and sometimes in another. Many terms are also redundant.

Describing is to a considerable extent an art. Even when it is practised as objectively as possible, as by the use the driest possible technical language and measurements, art creeps in. The ideal complete description should enable one mentally to picture, or actually to sit down and draw, the plant described without seeing it. Often not complete descriptions but differential diagnoses are required. A kind of shorthand is frequently used for descriptions and for diagnoses, consisting only of nouns, adjectives, and adverbs but in applying this there is at least in the background of one's mind, a translation into complete sentences. « Leaves lanceolate » means « The leaves have the outline shape I designate as lanceolate ». The technical abbreviation looks very objective but analysis suggests it is no more so than an equivalent full grammatical sentence, and it may be less precise. One has, therefore, to remember the often subtle and frequently highly subjective application of small, insignificantly looking, words of many modern languages, as well as of inflexions which they may replace especially in English. The meanings of words change and this has to be remembered in consulting literature. There are special dangers when such change of meaning is in process.

Tradition exerts its influence, though in varying degrees, on the mass of taxonomists. Bias or prejudice is more individual. Possibly

every one of us is born a « lumper » or a « splitter » or we early develop an inclination which is difficult to correct towards a broad or a narrow view of taxonomic categories. There is little doubt that we often tend to rationalize our methods after rather than before reaching a taxonomic decision. We may even say we possess a valuable degree of intuition as a kind of extra sense when we are merely prejudiced. If we recognize our predispositions we can at least tone down their activities. The application of simple statistics to a given problem may reduce our pride in our prejudices.

Again, most taxonomists have in a high degree the acquisitive instinct which works out in amassing large collections — often for an institution with which, for this purpose, the taxonomist integrates or even psychologically identifies himself. This condition is best defended by contending that facts have to be collected in order to reach valid generalizations. A minority of taxonomists, on the contrary, have a deductive bias and like to propound hypotheses from arm chairs. A search in botanical literature then leads them to find facts which can be claimed as deductions from their hypotheses. Induction is the usual method in botanical taxonomy, but it may be that a stimulating flavour might sometimes be added with advantage by introducing more deductive speculations so long as these are recognized for what they are and are not camouflaged as facts.

That the subjective element comes into play in classifying plants has been considered above in paragraphs dealing with tradition, language, bias, and so on. The writer is not competent properly to answer the questions : Is there any evidence that classifying has limits imposed by the past history of the human mind ? Are there mental factors genetically (or otherwise) inherited from pre-Adams and pre-Eves which make us classify in certain ways only ? In so far as we cannot utilize for most purposes anything beyond a linear classification, or visualize anything beyond a classification in three dimensions, except partially by some, often deceptive, device, we must suppose that there are mental limitations to classifying. Whether or not there is any indication in plant taxonomy of the action of a collective or racial unconscious, whether or not the archetype hypothesis has any bearing on our subject, must be left for psychologists of the Jung school and for professional philosophers to investigate.

In classifying there are classifiers and classified. In taxonomic botany there are taxonomists and plants. We write at length about

the peculiarities, the variability, and the behaviour and misbehaviour of plants. In this paper it is suggested that classifying is never entirely objective since the peculiarities and particularities of the human mind and of the individual taxonomist impose subjective elements on the result, whether deliberately as in some special classifications or less obviously, unconsciously, and even denied as in more general classifications. How far the subjective element can be eliminated or controlled, or even how far it is desirable to attempt so to treat it, is debatable. To recognize its existence is at least interesting and may have practical importance.

CATALOGUE COLLECTIONS AT THE JARDIN BOTANIQUE DE L'ÉTAT

BY

G. H. M. LAWRENCE,
Bailey Hortorium, Cornell University.

One of the finest collections of « classical » nursery catalogues and one destined to be of increasing importance to all horticulturists studying the nomenclature of cultivated ornamental plants, is that at the Jardin Botanique de l'État, Bruxelles. This collection is of great importance to botanists and to horticulturists because it reflects more accurately than any other similar collection the rich horticultural heritage accumulated over the last century in that Kingdom. This assemblage of catalogues of Belgian firms is believed to be the most complete of its kind anywhere. Members of the staff of the L. H. Bailey Hortorium have visited Bruxelles on several occasions to consult the publications housed there of such world-renowned firms as Van Houtte, and J. Linden (of Ghent, and later of Luxembourg). The holdings of firms of other European countries are outstanding and a few of the more complete deserve special mention : that for E. H. Krelaage (The Netherlands) is excellent for the period 1868-1921; those of Haage and Schmidt (Germany) cover the period 1875-1910 and are bound in 8 large volumes; V. Lemoine's (France) catalogues are for the period 1867-1911; while those of Bruant (Belgium) occupy six volumes and are for the period 1885-1914.

The finest collection at Bruxelles is undoubtedly that of the firm of Van Houtte, where the assemblage is more nearly complete than elsewhere. It commences with catalogue N° 4 (1840) and continues to N° 382 (1938). The number of missing numbers is relatively

small. For the period 1847-1890, there is an excellent but by no means complete collection of the lists and catalogues of J. Linden. The firms of A. Van Geert (Belgium) is represented by a collection covering the period 1848-1887, and that of Ch. Van Geert by the period 1843-1897. There is a marvelous group of catalogues of the French firm of de Vilmorin, covering the years 1866-1930, and bound in seven large volumes.

One of the primary sources of cultivar names, outside of horticultural monographs and existing regional or national check-lists, are these plant and seed catalogues issued by commercial firms. Too often, in all countries, each year's catalogues are discarded and destroyed when displaced by a new one. Too few, indeed are the botanical or horticultural libraries that have made conscientious effort to procure and preserve those issued in their own region or country. More amazing, investigation shows that there are many firms that do not possess a complete file of their own publications. Similarly there are today very few major collections of these catalogues anywhere in the world. None is known to be complete for a given period or for a given group of firms. My own observations lead me to believe that there are less than ten collections in existence that can be termed as outstanding— although I have no knowledge of collections outside of western Europe and North America.

The listings cited above are by no means an enumeration of the catalogue holdings at the Jardin Botanique de l'État, but attention is here focused on this library so that persons having the custody of similar — even if much smaller — collections will appreciate the significance and increasing value of this form of horticultural literature. The major collections known to me, aside from that at Bruxelles, are those at Haarlem, Genève, Kew, and (in the United States) at the Massachusetts Horticultural Society, the U. S. Department of Agriculture, and the L. H. Bailey Hortorium. As a measure of physical size, each of these collections occupies 25 meters or more of linear shelf space, and for some the space occupied is as much as 300 meters.

Botanists of the world have been organized more or less for about a century. Compared to other groups of biological scientists, including those in the applied branches, the number of these botanits has never been large — although at the present it is the largest ever. Within the field of botany, the naming of plant has very largely been accomplished by a comparatively small group of persons especially trained and competent is this work — work that

is done by the taxonomists. With some exceptions, taxonomists have operated within the provisions of existing codes or rules of nomenclature which, for the last half century or more, have been international in character. This has given some stability in nomenclature and much uniformity in procedure.

On the other hand, horticulturists of the world are not yet well organized. They are now beginning to become so. Compared to other groups of biological scientists the number of horticulturists is exceedingly large. Within the group there has not been a sufficiently large and continuing core of leaders in matters relating to horticultural nomenclature. There has not been, and is not today, any universally adopted code of nomenclature procedure for all cultivated plants. Fortunately, however, there is abundant reason to believe that adoption of such a code may materialize during the present decade.

To make the situation more difficult, horticulturists everywhere have not only been more promiscuous in publishing cultivar names in all forms of literature — some fugacious, too little of it permanent — but they have been most indiscreet in selecting media in which to publish those names. The situation truly approaches the chaotic, and only infinite patience, diligent investigation, and judicious legislation can in concert contribute to a more orderly state of affairs.

There is now being established what is believed will become an international code of nomenclature for cultivated plants acceptable to and adopted by agriculturists, horticulturists, and silviculturists throughout the world. Undoubtedly it will be a simple code. But in it the principle of name priority will undoubtedly be given a dominant place. At the same time, for those groups of plants represented by international registering bodies there will have to be allowances for special legislation (including independant starting points) to assure maximum stability in the nomenclature of cultivars within those groups. This is the beginning of what most botanists must concede as a step in the right direction.

There is no equivalent of an *Index Kewensis* for cultivar names. The nearest approach to such an *opus* will undoubtedly be in the form of international check-lists of cultivar names within particular groups. One for *Rosa,* another for *Rhododendron,* and one for *Narcissus,* is now in an advanced stage of preparation. Others are being planned or are in early stages of preparation. As is true of *Index Kewensis,* these works are compilations. Each is a nomenclator. It is essential that each be as complete as possible.

Readers knowing of other commercial catalogue collections, which are recognized as valuable for their completeness or for their overall size, are urged to contact the author so that more information may be assembled about their location, content, and scope. There is the hope that ultimately there may be compiled a central file of the holdings of the major seed and plant catalogue collections of the world (including the *indices semina* issued by botanical gardens). The need for such a central file is becoming increasingly evident. It is largely from this literature that dates of introduction, names, and descriptions (even although scant) are to be located for thousands of former and existing cultivars.

The administrators of the Jardin Botanique de l'État, Bruxelles, are to be commended for the care given the collections in their charge. It is hoped that they and administrators of similar botanical institutions, recognizing the value of this material to future horticultural systematists, will redouble their efforts to keep existing collections up to date, and will encourage the contribution to their respective institutes of lesser but most important catalogue collections now held by private individuals and fanciers.

OUTLINE OF A NEW SYSTEM OF FAMILIES AND ORDERS OF DICOTYLEDONS

BY

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It is now generally admitted among students of angiosperm phylogeny that the *Ranales* in the broad sense represent the most primitive existing group of angiosperms, and that most of the principles or dicta regarding evolutionary trends set forth by Bessey (1915) and later by Hutchinson (1926) are fundamentally sound. Although the scheme of relationships of monocotyledons presented by Hutchinson (1934) has been widely admired, no published treatment of the dicotyledons is generally accepted as even approximately correct. The system of Soo' (1953) is perhaps the most valid modern rearrangement, but it leaves me still unsatisfied in a number of respects. I believe that the evidence of relationships which has been made available during the past several decades, including the results of embryological, anatomical, palynological, and serological studies, as well as of the more traditional methods, warrants a new attempt to produce a natural system of dicotyledonous families and orders.

An outline of a new system of dicotyledons is presented in this paper. In arriving at the concepts here presented, I have tried to follow a principle which has been stated in one form or another by Linnaeus, Persoon, and many subsequent botanists, the importance of which has not always been sufficiently emphasized : Every taxonomic character is potentially important, and no character has an

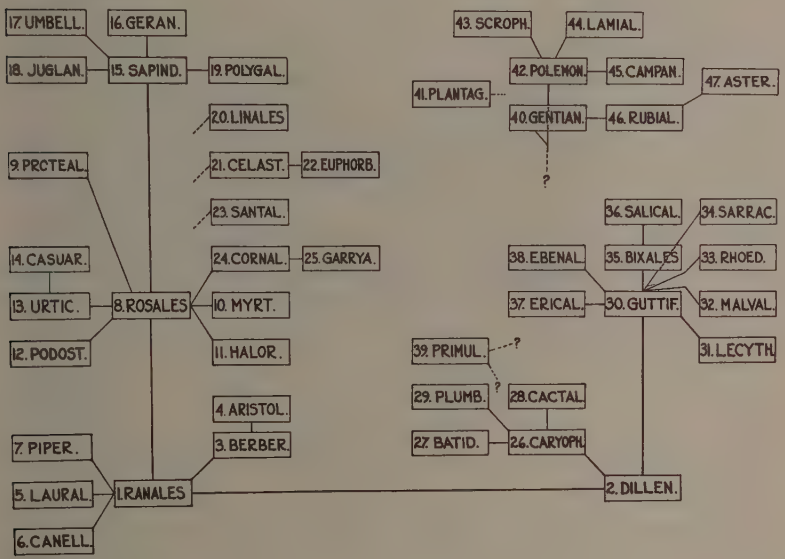
inherent, fixed importance; each character is only as important as it proves to be in any particular instance in defining a group which has been perceived on the basis of all of the available evidence. Experience shows us that some characters are much more stable and thus more likely to be important than others, and that there are many essentially unidirectional evolutionary trends, but any taxonomic system which assigns a fixed and necessary value to a particular character is to that extent artificial rather than natural.

One of the great weaknesses of all current schemes of classification of dicotyledons is the vagueness of the distinctions between the orders. Parallelism and convergence have been so rampant throughout the class that this difficulty cannot be wholly conquered, but particular attention has been paid in the present scheme to arriving at orders which are morphologically coherent even if not always precisely definable.

Believing that I may be able to amplify the present scheme after a few years, and hoping that in the meantime other botanists will call to my attention evidence which suggests the need for correction, I think it may now suffice to present a synopsis of the orders, a chart showing their presumed relationship, a suggested linear sequence of families, and a brief explanation of the system. A detailed exposition and defense of the system is reserved for a later publication, but some of the more significant papers which bear on certain conclusions are cited. Those who are familiar with the compendia of Erdtman (1952) and of Metcalfe and Chalk (1950) will note the frequent use of data from these works without specific citation. The list of families is included primarily to indicate the contents of each order, although some attention has also been paid to the sequence within the orders. The status of certain taxa as families or something less than families is of relatively minor importance from the standpoint of this paper, and some subsequent adjustments will doubtless be necessary.

The chart suffers from the inherent limitations of all phyletic trees based on existing taxa. It should in all cases be understood that the indication of an order *a* as ancestral to an order *b* means merely that a precursor or common ancestor to the families of order *b* would fall within or very near the limits of order *a*. For example, the only essential character by which the *Dilleniales* differ from the *Ranales* is the sequence in which the stamens develop. A plant which differed from the *Dilleniales* only in having the presumably more primitive, centripetal sequence of development, instead of the centrifugal

sequence which marks the *Dilleniales,* would be referred to the *Ranales,* and the *Dilleniales* are accordingly regarded as derived from the *Ranales.* The length of the line connecting these two orders on the chart is governed solely by the exigencies of two-dimensional representation.



The *Ranales* are here considered to constitute the most primitive existing order of angiosperms. The numerous recent papers of I. W. Bailey and his associates on ranalean and related groups, mostly published in the *Journal of the Arnold Arboretum,* are too well known to require detailed citation here. Two of the most important of these papers are by Bailey & Swamy (1951) and by Money, Bailey, and Swamy (1950). The treatment here presented is believed to be consistent with the data presented by Bailey et al., although I do not always rigidly follow their taxonomic interpretations. The concepts of phyllospory and stachyospory as advocated by Lam (1948) have been adequately dealt with by Eames (1951) and others, and are here specifically rejected.

A small group of families which might with some reason be included in the *Ranales* is the *Dilleniales,* characterized by their apocarpous flowers and centrifugal stamens. The significance of the centrifugal as opposed to the centripetal sequence of development

of stamens has been emphasized by Corner (1946), who also points out that on this character *Paeonia* is allied to the *Dilleniaceae* rather than to the *Ranunculaceae*. *Paeonia* was excluded from the *Ranunculaceae* on anatomical and other grounds as early as 1908 by Worsdell, who was unaware of the difference in the stamens. More recent studies of the chromosome number and morphology by Gregory (1941) and of serological reactions by Hammond (1955) tend to support the removal of *Paeonia* from the *Ranunculaceae*. It may also be worth noting at this point that Hammond's serological tests indicate a relationship of *Hydrastis* and *Glaucidium* to undoubted *Ranunculaceae*, although some botanists would exclude these genera from the family. The association of the *Crossosomataceae* with the *Paeoniaceae* and *Dilleniaceae* was suggested by Camp in Gundersen (1950), and has been further supported on anatomical grounds by Eames (1953). The *Dilleniales* are apparently the starting point for two lines of evolutionary development, and it is therefore useful to retain them as a distinct order in spite of their obvious relationship to the *Ranales*.

An offshoot of the *Ranales* which tends toward syncarpy, while remaining hypogynous, is the *Berberidales*. The similarity of some of the *Ranunculaceae* to some of the *Berberidaceae* is well known. The seemingly monocarpous gynoecium of the *Berberidaceae* has been shown by Chapman (1936) to be actually syncarpous, with all but one of the carpels generally obsolete. The *Berberidales* are woody, with broad wood rays, varying to wholly herbaceous; many of them are climbers. Their stamens tend to be cyclic, mostly in more than one series, with one of the series opposite the petals. The *Aristolochiaceae*, forming an order of their own, are as pointed out by Hutchinson (1926,1948) a further development from the *Berberidales* with inferior ovary, no petals, and more or less petaloid calyx. They retain a relatively primitive type of pollen.

The *Laurales* constitute an offshoot from the *Ranales* marked by their perigynous to epigynous flowers in which the perianth is scarcely or not at all differentiated into calyx and corolla. They have well developed ethereal oil cells, as in many of the *Ranales*, and they retain a relatively primitively type of pollen. A few of the *Laurales* are syncarpous, with axile placentation; the others are apocarpous. A recent study of the vascular anatomy of the *Calycanthaceae* by Fahn & Bailey (1957) in effect supports the position of this family as a member of the *Laurales*.

The *Canellales* (1), composed of a single small family *Canellaceae*, are a developement from the *Laurales* or near thereto. The *Myristicaceae*, a peripheral family of the *Laurales* which might with some reason be referred to the Ranales instead, are particularely suggestive of the *Canellaceae*. The similarities between the *Myristicaceae* and *Canellaceae* have been pointed out by Vestal (1937) and others. The *Canellaceae* retain the monocolpate pollen and ethereal oils of the *Laurales*, but they have a syncarpous ovary with parietal placentation, and they often have well differentiated petals.

The *Piperales* are a ranalean offshoot tending toward reduced, clustered, unisexual flowers. They retain the monocolpate (or in any case not tricolpate) pollen and the well developed ethereal oil cells. These latter characters tend to ally them also with the *Laurales*.

The *Rosales* constitute still another offshoot from the *Ranales*. The several families of the *Rosales* are held together by their evident relationship to each other, but the order is otherwise scarcely characterizable. There are strong but only partly correlated tendencies in the Rosales toward syncarpy, perigyny-epigyny, and reduction in number of stamens.

The *Proteales* are a strongly perigynous development from the *Rosales* in which the petals have been lost and the carpels have been reduced to one. Some additional characters shared by the two families (*Proteaceae* and *Elaeagnaceae*) of the *Proteales* are the tetramerous, valvate perianth, tanniferous secretory cells, and scanty or no endosperm.

All of the remaining orders are largely or wholly syncarpous, although there are a few apocarpous (these chiefly monocarpous) families. The *Myrtales* are a perigynous to epigynous group with the stamens seldom less than twice as many as the petals. They have opposite leaves, and generally have intraxylary phloem. The stamens, when numerous, develop in centripetal sequence. This latter character tends to ally the *Myrtales* with the *Rosales* rather than with the *Guttiferales*, which have sometimes been suggested as possible ancestors. In a remarkable *tour de force* on the significance of nectaries in angiosperm phylogeny, Brown (1938) also concluded that the *Myrtales* are derived from the *Rosales*.

(1) *Canellales* ord. nov. Arbores vel frutices aromatici, floribus hypogynis, staminibus numerosis connatis, polline monosulcato, ovario syncarpio, placentis parietalibus, cotyledonibus duobus.

The *Haloragales* (2) are a perhaps un-natural group, mostly aquatic, with reduced flowers. Most of them have often been included in the *Myrtales*, where they form a discordant element with well developed endosperm and without intraxylary phloem. The *Gunneraceae*, of this order, are reminiscent of the *Araliaceae*, of the *Umbellales*. The *Callitrichaceae*, here provisionally referred to the *Haloragales*, have sometimes been thought, perhaps correctly, to be related to the sympetalous orders because of the ovular structure and some embryological features (Jørgensen, 1923, 1925). Rather than to establish still another new order, I prefer for the present to retain the *Callitrichaceae* as a doubtful member of the *Haloragales*.

The *Podostemonales* are a group of aquatics with reduced flowers and modified vegetative structure. They are closely linked to the *Rosales*, particularly the *Crassulaceae*, by some embryological features (Mauritzon, 1939a).

The *Urticales*, here defined to include the *Balanopsidales*, *Fagales*, *Leitneriales*, and *Myricales*, as well as the *Urticales* sens. strict., constitute a majority of the amentiferous groups. Most of them are now generally admitted to be derived by floral reduction from woody members of the Rosales similar to the present day *Hamamelidaceae*, a view which is here accepted. Of the now rather numerous papers which tend to support this conclusion for one or another family or assemblage of families in this group, the study by Tippo (1938) is among the most important. The *Casuarinales* are a further development from the *Urticales*, so different from the other members of the group as perhaps to warrant being held in a separate order. This treatment is readily compatible with the views of Moseley (1948), who considered the *Casuarinaceae* to be derived from ancestors similar to the *Hamamelidaceae*.

The *Sapindales* as here defined are a group of mostly woody plants with compound leaves, including also a few simple-leaved derivatives. They are derived from the *Rosales*, near the *Cunoniaceae*. The more primitive families of the order have numerous ovules, but the others have only one or two ovules per locule. The stamens are mostly in only one or two series, and there is usually an evident disk which is probably derived from another staminal whorl. The treatment here proposed for the orders *Sapindales*, *Geraniales*, *Polygalales*, and *Linales*, largely on the basis of macroscopic cha-

(2) *Haloragales* ord. nov. Herbae saepe aquaticae, floribus reductis saepe unisexualibus, ovario inferiore vel nudo, seminibus albumine evoluto, cotyledonibus duobus.

racters, is strongly supported in a number of respects by the important work of Heimsch (1942) on the wood anatomy of these groups.

The *Juglandales* are a more or less amentiferous offshoot, or possibly a series of offshoots, from the *Sapindales*. The precise relationships of the four families here placed in the *Juglandales* to each other and to the families of the *Sapindales* remain to be clarified The relationship between the *Julianaceae* and *Anacardiaceae* appears to be especially close, on the basis of the wood anatomy (Stern, 1952). The *Juglandaceae* and *Rhoipteleaceae*, on the other hand, are evidently related to each other (Manning, 1938, 1940, 1948; Withner 1941) but have a more primitive wood structure than either the *Anacardiaceae* or the *Julianaceae* (Heimsch, 1942). The wood of the *Picrodendraceae* has not been studied with a view to its bearing on the taxonomic position of the family. The *Julianaceae* have usually been considered to be related to the *Juglandaceae*, and I am not convinced that the admitted anatomical differences preclude such a relationship. It is noteworthy that Manning found the inflorescence of the *Anacardiaceae* to have the characters of the hypothetical ancestral prototype of the *Juglandaceae*, and that Tippo excluded the *Juglandaceae* from the group here treated as the *Urticales*, with the further comment that a sapindalean relationship for the family was probable.

The *Umbellales* are an epigynous offshoot from the *Sapindales*. They generally have a well developed corolla, and tend to have an umbellate inflorescence. The tropical woody *Araliaceae*, with well developed secretory canals, multilacunar nodes, and large, pinnately compound leaves, would be quite at home in the *Sapindales* if the flowers were hypogynous rather than epigynous. The numerous anatomical differences between the *Umbellales* proper and the *Cornaceae* have been pointed out by Hoar (1915) and specifically reaffirmed by Metcalfe & Chalk (1950) as a strong indication that any relationship between these groups is much less close than has sometimes been assumed.

The *Geraniales* are an herbaceous offshoot from the *Sapindales*, with a tendency also toward simple leaves. On the basis of chromosome number and morphology, Warburg (1938) suggested that the *Oxalidaceae*, *Geraniaceae*, and *Tropaeolaceae* are closely related, while the *Limnanthaceae* are somewhat more distant. The *Balsaminaceae*, sometimes placed near the *Geraniaceae* but in the present treatment referred to the *Polygalales*, are cytologically more different from the *Oxalidaceae*, *Geraniaceae*, and *Tropaeolaceae* than

these three families are from each other. The *Linaceae* and *Zygophyllaceae* are also more distant, as judged from the relatively scanty cytological evidence.

The *Polygalales* are a development from the *Sapindales* characterized by their simple leaves and mostly zygomorphic flowers, which also show a tendency toward sympetaly and connate filaments. The *Malpighiaceae*, in some respects the most primitive family of the order, are obviously allied to the *Sapindaceae*. The jointed petioles found in many *Malpighiaceae* suggest that the simple leaf in this family and probably in the whole order is derived from a unifoliolate compound leaf. The close relationship among the *Malpighiaceae*, *Trigoniaceae*, *Vochysiaceae*, *Tremandraceae*, *Xanthophyllaceae*, and *Polygalaceae* was strongly supported by Heimsch (1942) on the basis of wood anatomy. The other two families here referred to the *Polygalales*, the *Balsaminaceae* and *Stackhousiaceae*, were not studied by Heimsch.

The *Linales*, *Celastrales*, and *Cornales* are simple-leaved groups which, like the *Sapindales*, tend to have only one or two ovules per locule. They are all derived eventually from the *Rosales*, but their relationships among themselves and with the *Sapindales* are not clear. The *Linales* as here defined were considered by Heimsch (1942) to be closely allied to the *Polygalales* as here defined, on the basis of the wood anatomy, and to be more distant from the *Geraniales* as here defined. The *Celastrales* consist of three small groups of mostly haplostemonous families which may perhaps better be treated as three orders, the *Rhamnales*, the *Celastrales* proper, and a third order for the *Aquifoliaceae*, *Dichapetalaceae*, and *Icacinaceae*. The position of the *Rhamnaceae* as a close ally of the *Celastraceae* is supported by the studies of Prichard (1955). The *Euphorbiales* are probably related to and derived from the *Celastrales*, showing particular affinity with the third of the three groups of that order. They are marked by their mostly unisexual and apetalous flowers, and commonly tricarpellate ovary. The possibility that the *Euphorbiaceae* are un-natural, polyphyletic group has repeatedly been suggested but remains to be demonstrated; I am not convinced that the evidence requires such an interpretation. The similarity of the nectaries of the *Euphorbiaceae* to those of the *Celastrales* and *Sapindales* was pointed out by Brown in 1938.

The *Cornales* are an epigynous group which seem to be derived directly from the *Rosales*. The *Cornaceae* have some anatomical and other features in common with the present day *Hydrangeaceae*, of

the *Rosales*. Some of the *Myrtales* are also not far distant from some of the *Cornales*. The *Rhizophoraceae*, here included in the *Cornales*, have usually been referred to the *Myrtales*, where they are anomalous in embryological features (Mauritzon, 1939*a*) as well as in the absence of intraxylary phloem. The *Garryales* are an amentiferous offshoot of the *Cornales*, as indicated *inter alia* by Moseley & Beeks (1955); they are maintained as a separate order chiefly to facilitate the morphological definition of the *Cornales* and *Urticales*.

The *Santalales* are a group modified toward parasitism and simplified ovules. The most primitive family of the group, the *Olacaceae*, seems to be allied to the *Icacinaceae* of the order *Celastrales*, but the fact that some *Olacaceae* have relatively numerous stamens suggests that the *Santalales* may perhaps be derived directly from the *Rosales* rather than through the *Celastrales*. The close relationship among the chlorophyllous families of the *Santalales*, and of these to the non-green *Balanophoraceae*, is thoroughly established (Smith & Smith, 1942; Fagerlind, 1947; Reed, 1955). The non-green families *Hydnoraceae*, *Mitrastemonaceae*, and *Rafflesiaceae* are evidently related among themselves. Although they are somewhat removed from the remainder of the order, no other relationship seems even remotely possible, and the pollen morphology tends to support the position suggested by the more obvious characters.

Concluding the rosalean line, we turn now to the orders which relate to the *Ranales* through or near the *Dilleniales*. The *Caryophyllales (Centrospermae)* are a chiefly herbaceous group derived from the *Dilleniales*, or near thereto. Maheshwari (1950) among others has pointed out a series of coherent embryological features which help to distinguish the *Caryophyllales* from most other orders. The most nearly constant morphological feature of the order is the structure of the seed, which has a curved, peripheral embryo that more or less surrounds the food storage tissue, this usually being perisperm rather than true endosperm. The *Aizoaceae*, of this order, have centrifugal stamens, as do the *Dilleniaceae*. Another feature which characterizes most but not all of the order is a strong tendency toward free-central and eventually basal placentation. The position of the *Nyctaginaceae* in the *Caryophyllales* rather than elsewhere is confirmed by the embryological features (Mauritzon, 1939*b*), structure of the nectaries (Brown, 1938), chemical nature of the anthocyanins (Gibbs, 1945), and pollen morphology, among other

characters. The seeds of some of the *Polygonaceae* are scarcely centrospermous, but these aberrant types are connected to the more normal centrospermous type by a series of intermediates within the family (Martin, 1946), and there does not seem to be any sound basis for questioning the position of the *Polygonaceae* in the *Caryophyllales*.

It is possible that the *Caryophyllales* are derived directly from the *Ranales*, and that the centrifugal development of the stamens in the *Dilleniales* and *Caryophyllales* is a mere parallelism that does not indicate direct relationship. Dr. Franz Buxbaum has suggested in personal conversation that something similar to *Illicium (Illiciaceae, Ranales)* might well be directly ancestral to the *Phytolaccaceae*, which are often apocarpous and may represent the most primitive existing family of the *Caryophyllales*. However, the similarities between the nectaries of the *Caryophyllales* and *Guttiferales* pointed out by Brown (1938) are perhaps best explained by considering that these two orders have a common ancestor in the *Dilleniales*.

The *Batidales*, containing only a single family, genus, and species, are an amentiferous « group » which resemble some of the smaller-flowered *Chenopodiaceae*. It is convenient to retain the *Batidales* as an order to facilitate the morphological definition of the *Caryophyllales*.

The *Cactales*, containing only the family *Cactaceae*, are allied to the *Caryophyllales*, as indicated by the embroylogy (Mauritzon, 1939*b*; *Maheshwari*, 1950), pollen morphology (Erdtman, 1952), and chemical nature of the anthocyanins (Gibbs 1945), a well as by some evident similarities, both floral and vegetative, to the *Aizoaceae* and *Phytolaccaceae* which have been emphasized by Buxbaum (1948, 1949) and others. According to Gibbs, nitrogenous anthocyanins are known only in the families *Aizoaceae, Amaranthaceae, Basellaceae, Cactaceae, Chenopodiaceae, Nyctaginaceae, Phytolaccaceae*, and *Portulacaceae*. All of these families except the *Cactaceae* belong to the *Caryophyllales*. The mostly non-endospermous seeds, the inferior ovary, and the parietal placentation of the *Cactaceae* would all be aberrant features in the *Caryophyllales*, and it therefore seems advisable to retain the *Cactales* as a distinct order.

The *Plumbaginales*, containing only the family *Plumbaginaceae*, are derived from the basal part of the *Caryophyllales*, near the *Phytolaccaceae*. Friedrich (1956) adduces evidence in support of this view from external morphology, developmental and mature

anatomy, embryology, and cytology. The inclusion of the *Plumbaginaceae* within the *Caryophyllales*, as suggested by Friedrich, is on the other hand unnecessary. The sympetalous corolla (whatever its evolutionary origin) and the straight embryo of the *Plumbaginaceae* would both be aberrant features in the *Caryophyllales*, and these characters furnish sufficient basis for the maintenance of the *Plumbaginales* as an order. The *Plumbaginaceae* have often been included in the *Primulales*, but the relationship at best is no more than a parallel development from similar ancestors. In this connection it is of some interest that the pollen grains of the *Theophrastaceae*, *Myrsinaceae*, and *Primulaceae* have much in common, while those of the *Plumbaginaceae* are quite different.

The *Guttiferales* are very closely allied to the *Dilleniaceae*, differing principally in being syncarpous. They are mostly hypogynous, with typically numerous, centrifugal stamens, and with axile placentation. Most of the *Guttiferales* are woody. The relationship between the *Dilleniaceae* and the *Guttiferales* has been so generally accepted that it seems unnecessary to document it here. In a proper three-dimensional diagram the *Dilleniales* would lie directly between and immediately adjacent to both the *Ranales* and the *Guttiferales*. Here as elsewhere the length of the lines separating the orders on the two dimensional chart presented with this paper is governed more by the limitations of space than by the closeness of the relationship.

The *Lecythidales* (3) have often been included in the Myrtales, where they are anomalous in their alternate leaves, centrifugal stamens, lack of intraxylary phloem, and embryological features; the embrogoly has been discussed in some detail by Mauritzon (1939a). The centrifugal stamens and syncarpous ovary would seem to ally them to the *Guttiferales*, from which they are distinguished by the epigynous flowers.

The *Malvales* are derived from the less modified members of the *Guttiferales*, being marked by their valvate rather than imbricate calyx, and by their consistently stellate or lepidote pubescence. The *Malvales* also show a strong tendency toward monadelphous filaments. The *Elaeocarpaceae* are one of the more primitive families of the *Malvales*, as judged by the general floral morphology, wood anatomy, and lack of the special type of nectary found in the other families of the order. The relationship of the *Elaeocarpaceae* to the

(3) *Lecythidales* ord. nov. Arbores vel frutices sine phloemate intraxylario, floribus plus minusve epigynis, calyce saepe valvato, staminibus numerosis centrifuge evolutis, cotyledonibus duobus.

other families of the order has been generally admitted, and has been accepted by Edlin (1935) as well as being supported on embryological grounds by Mauritzon (1934). Some of the *Elaeocarpaceae* are very similar to some of the *Flacourtiaceae*, as has been pointed out to me by C. Earle Smith, Jr., and this similarity between the families extends even to the pollen morphology, according to Erdtman (1952). The *Flacourtiaceae* are one of the less modified families of the *Bixales (Parietales)*, another order which is derived from the *Guttiferales*. Any common ancester of the *Flacourtiaceae* and *Elaeocarpaceae* would presumably have an imbricate calyx and axile placentation, and thus would fall within the bounds of the *Guttiferales* rather than either the *Malvales* or *Bixales*.

The *Rhoeadales* are an offshoot of the *Guttiferales* with mostly parietal placentation. This is the only order which is so far definitely known to have both centripetal *(Papaveraceae)* and centrifugal *(Capparidaceae, Crucifereae)* stamens, but the order is so coherent in other respects that any attempt to divide it seems unwise at this time. The *Rhoeadales* are hypogynous, and have strong tendencies toward herbaceousness.

The *Sarraceniales* are an insectivorous group derived from the *Guttiferales*. The *Rhoeadales* and the *Dioncophyllaceae (Bixales)* have also been suggested as allies of the *Sarraceniales* but in each of these cases the relationship is probably through a guttiferalean common ancestor. The relationship of the *Byblidaceae* and *Droseraceae*, on the one hand, to the *Sarraceniaceae* and *Nepenthaceae*, on the other, has sometimes been questioned. The strong similarity between the pollen grains of the *Droseraceae* and *Nepenthaceae* gives some support to the traditional practice of keeping all four families together.

The *Bixales* are another offshoot of the *Guttiferales* with parietal placentation. As here defined the order includes most of the Englerian order *Parietales*, except the suborder *Theinae*, which is here treated as the order *Guttiferales*. The name *Parietales* is not in accordance with the present rules of nomenclature, and must be abandoned. The distinction here drawn between the *Guttiferales* and the *Bixales*, and the position of the *Flacourtiaceae* as a relatively primitive member of the *Bixales*, are supported on anatomical grounds by Vestal (1937). Unlike the *Rhoeadales*, the *Bixales* have strong tendencies toward perigyny-epigyny and toward sympetaly. The *Cucurbitaceae* are clearly a member of this order, as has previously been suggested by several other botanists; this disposition

of the family also receives some support from the pollen morphology (Erdtman, 1952) and the nectary structure (Brown, 1938). The relationship of the Salicales has long been a matter of conjecture. One of the most reasonable suggestions, on the basis of the traditional criteria, is that they are derived by floral reduction from something similar to the *Flacourtiaceae*. This disposition of the group is strongly supported by the structure of the nectaries (Brown, 1938). Brown also considered that the nectary structure indicates a relationship among the orders *Rhoeadales, Bixales,* and *Salicales,* as those orders are here defined.

The *Ericales* and *Ebenales* are allied, chiefly sympetalous groups which are independently derived from the *Guttiferales*. The *Clethraceae* have often been included in the *Ericaceae,* to which they are evidently related, and with which they share many anatomical features. The general morphology of the *Clethraceae* is at least as consistent with a position in the *Guttiferales,* however, and both the pollen (Erdtman, 1952) and the nectaries (Brown, 1938) tend to support this latter position. Copeland (1938) presents evidence in favor of deriving the *Ebenales* from the *Guttiferales* as here defined, and cites with approval the conclusions of previous workers that the *Ericaceae* have a similar ancestry. The position of the *Empetraceae* as apetalous derivatives of the *Ericaceae* is strongly indicated by the embryology (Samuelsson, 1913) and pollen morphology (Erdtman, 1952) as well as by anatomical and general morphological features (Hagerup, 1946). The several differences between the *Empetraceae* and the bulk of the *Ericales* might permit the erection of a separate order for the *Empetraceae,* but no such segregation is here proposed.

The *Primulales* are a sympetalous order of doubtful affinities. They may perhaps be allied to the *Caryophyllales,* as has frequently been suggested, but there is very little other than the free-central placentation to indicate this, and it should be noted that derivation of the tropical, woody family *Myrsinaceae (Primulales)* from a chiefly herbaceous group such as the *Caryophyllales* might pose some difficulties. A resort to woody members of the *Caryophyllales* such as some of the *Phytolaccaceae,* as possible near-ancestors of the *Primulales* tends to vitiate the significance of the free-central placentation as an indicator of relationship between the *Primulales* and *Caryophyllales,* inasmuch as the genera of the *Phytolaccaceae* with united carpels have axile placentation. If the *Primulales* are indeed related to the *Caryophyllales* it must be through a woody

common ancestor with axile placentation or even with separate carpels, and the free-central placentation has been independently achieved in both groups. On the basis of present evidence the *Guttiferales* meet the qualifications of a possible ancestor of the *Primulales* at least as well as do any of the *Caryophyllales*. In the system here presented the more primitive members of the *Guttiferales* are really not very far removed from the more primitive members of the *Caryophyllales*, so the two alternative positions for the *Primulales* are perhaps not so different as they might at first seem. From the standpoint of a linear sequence, there is no harm in leaving the *Primulales* in their customary Englerian position following the *Ericales* and *Ebenales*, a position which would be wholly compatible with regarding these three orders as separate offshoots from the *Guttiferales*.

The orders *Gentianales, Plantaginales, Polemoniales, Scrophulariales, Lamiales, Campanales, Rubiales,* and *Asterales* constitute a coherent, largely or wholly natural group that are held together by their general morphology, by genera which tend to link otherwise distinct families, and by usually having a single very thick ovular integument. The origin of this group of orders is not clear. The *Guttiferales, Rosales,* and some derivatives from the *Rosales* (such as the *Linales, Celastrales,* and even *Sapindales)* are possible ancestors. The fact that most of the *Gentianales* and *Polemoniales* have intraxylary phloem should not be overlooked as a clue to relationship. This character is elsewhere almost entirely restricted to the *Myrtales,* but the *Myrtales* can scarcely be considered directly ancestral to this group of sympetalous orders, inasmuch as they (the *Myrtales)* are strongly perigynous to epigynous, whereas the more primitive orders of this sympetalous group are hypogynous. Until the affinity of this group of sympetalous orders is better established they may be allowed to remain in their customary Englerian posi- a position which would be wholly in confirmity with one of the possible derivations of the group (from the *Guttiferales)*. Brown, (1938) considered that the nectary structure of the *Polemoniales, Scrophulariales,* and *Lamiales* indicates a close relationship of these orders to each other and their probable derivation from the *Guttiferales*.

There is no clear morphological distinction between the *Gentianales (Contortae)* and *Polemoniales,* although most of the *Gentianales* have opposite leaves, while most of the *Polemoniales* have alternate leaves. The *Buddleiaceae* and *Menyanthaceae*, of the *Gentianales,*

have not always been accepted as distinct families, but Tournay and Lawalrée (1952) have recently pointed out that these two families stand apart from the families to which they have been referred(*Loganiaceae* and *Gentianaceae,* respectively) and resemble the *Oleaceae* in a series of anatomical and embryological features. I am not convincd, however, that these differences require the recognition of two distinct orders. Suborders might serve the purpose just as well, while doing less violence to the traditional arrangement.

The *Scrophulariales (Personales)* are an offshoot of the *Polemoniales,* characterized by zygomorphic flowers and reduction in the number of stamens. The close affinity between the *Scrophulariaceae* and the *Solanaceae (Polemoniales)* is well known. The other families of the *Scrophulariales* are derived directly or indirectly from the *Scrophulariaceae.*

The exclusion of the *Lennoaceae* from the *Ericales* is supported by Copeland (1935) and others on general morphological grounds, by Maheshwari (1950) on embryological grounds, and by Erdtman (1952) on the pollen morphology. The position here assigned to the family (in the *Polemoniales*) is not inconsistent with the arguments which have been advanced for placing it near the *Boraginaceae,* inasmuch as the *Lamiales* (to which the *Boraginaceae* belong) are here considered to be derived directly from the *Polemoniales.* The *Lamiales* are an offshoot from the *Polemoniales,* characterized by fruits which separate as one-seeded nutlets. The similarity between the *Boraginaceae (Laminales)* and *Hydrophyllaceae (Polemeniales)* is generally believed to reflect a relationship between these two families. The tropical, woody members of the *Boraginaceae* have much in common with the tropical woody members of the *Verbenaceae,* and these two families are also linked by similarities in the pollen morphology. The relationship between the *Verbenaceae* and the *Labiateae is* well known. The *Phrymaceae* are generally conceded to be a modified type derived from the *Verbenaceae.*

The *Plantaginales,* containing only the family *Plantaginaceae,* are taxonomically somewhat isolated. There is no obvious reason to remove them from their customary position near the other sympetalous orders, however, and their ovules have the single large integument which characterzies most of the other members of the group.

The *Campanulales* are an epigynous development from the *Polemoniales.* The *Rubiales* are an epigynous development from the *Gentianales,* and the *Rubiaceae* are even connected to the *Loganiaceae (Gentianales)* by a genus of doubtul position. Reasons for

considering the *Asterales* to be derived from near the base of the *Rubiales* rather than from the *Campanuales* were discussed at some length by Cronquist in 1955.

The following synopsis of the orders of dicotyledons is intended to indicate the characteristic features of each other, along with some of the more prominent exceptions. It is not intended to provide for all of the aberrant forms.

Synopsis of the orders of dicotyledons

1. Plants either with the flowers mostly apocarpous, or with the pollen of monocolpate or monocolpate-derived type (notable exceptions in the *Rosales* and *Berberidales*); integuments generally 2 (1 in some *Rosales*); flowers usually polypetalous or apetalous, but often gamosepalous.
2. Stamens mostly numerous and developing in centripetal sequence (few in *Tetracentraceae*, some *Ranunculaceae*); carpels mostly free, 2-many (1 in *Degeneria*); flowers mostly hypogynous; stamens mostly dehiscent by longitudinal slits, or sometimes irregularly dehiscent, not dehiscent by valves . . . . . 1. *Ranales*.
2. Plants generally differing in one or more respects from the *Ranales* as characterized above.
3. Stamens numerous and developing in centrifugal sequence; seeds generally arillate except in *Paeoniaceae;* calyx and corolla usually well differentiated; flowers apocarpous; no secretory cells . . . 2. *Dilleniales*.
3. Stamens either few, or numerous and developing in centripetal sequence; seeds seldom arillate; flowers apocarpous or syncarpous; secretory cells present or absent.
4. Flowers not crowded into a spadix-like inflorescence, and not at once epigynous and without a perianth; ovules mostly anatropous.
5. Plants generally either apocarpous, or with tricolpate (or tricolpate-derived) pollen, or with an inferior ovary.
6. Flowers hypogynous; stamens 2-many, often isomerous with and opposite to the petals (perianth rarely wanting); mostly exstipulate; mostly without secretory cells, but sometimes with secretory sacs or canals that do not contain ethereal oils; pollen tricolpate to monocolpate; plants herbaceous to woody, often climbing, the woody forms mostly with wide or very wide wood rays . . . 3. *Berberidales*.
6. Flowers mostly perigynous to epigynous, hypogynous in a few *Rosales;* stipulate or exstipulate, with or without secretory cells; stamens when few mostly not opposite the petals.
7. Ovary inferior (occasionally only partly so), syncarpous; petals none; calyx gamosepalous and more or less strongly corolloid, tending to be 3-lobed or irregular; carpels 4-6; pollen monocolpate or acolpate; stamens few to many, often adnate to the short style; shrubs and herbs, often climbing . . . . . 4. *Aristolochiales*.
7. Ovary superior, or plants without petaloid calyx, or both; other characters various.
8. Perianth usually clearly differentiated into calyx and corolla, or the plants occasionally apetalous; pollen mostly tricolpate; plants woody or herbaceous, stipulate or exstipulate, with or without secretory cells, and with apocarpous or syncarpous flowers 8. *Rosales*.
8. Perianth scarcely or not at all differentiated into calyx and corolla, though often biseriate; plants woody (except in a few

Proteaceae), exstipulate, generally with well developed secretory cells.

9. Perianth consisting of a single more or less strongly corolloid cycle of mostly 4 members, these connate into a tube with valvate lobes; stamens mostly 4 (8), dehiscent by longitudinal slits; secretory cells containing tanniferous substances; pollen (2) 3-colpate; endosperm scanty or none; carpel 1 . . . 9. *Proteales.*

9. Perianth not strongly corolloid, of one or more cycles or a spiral, seldom tetramerous; stamens seldom 4, often dehiscent by valves; secretory cells containing ethereal oils; pollen mostly monocolpate, acolpate, dicolpate, or polycolpate, only rarely tricolpate; endosperm present or absent; carpels 1-several . . . . . 5. *Laurales.*

5. Plants with a superior, syncarpous ovary and parietal placentation; stamens monadelphous, extrorsely dehiscent; pollen monocolpate; woody plants with ethereal oil cells . . . . . 6. *Canellales.*

4. Flowers tending to be crowded into a spadix-like inflorescence, essentially without perianth, and either syncarpous or epigynous; pollen of monocolpate or monocolpate-derived type; ethereal oil cells present; ovules orthotropous . . . . . 7. *Piperales.*

1. Plants with the flowers mostly syncarpous, seldom apocarpous or monocarpous (monocarpous in the *Nyctaginaceae,* among others); pollen of tricolpate or tricolpate-derived type.

10. Flowers mostly polypetalus or apetalous, seldom sympetalous; integuments generally 2, occasionally (especially in the *Santalales*) only 1 or none.

11. Plants tending to be modified toward either parasitism or entomophagy; leaves mostly alternate (except some *Santalales*); endosperm well developed.

12. Plants modified toward entomophagy, the leaves or some of them producing digestive juices and either provided with sticky hairs or modified into pitcher-like structures; herbs or shrubs with perfect, regular, hypogynous, more or less polypetalous flowers and loculicidal capsules . . 34. *Sarraceniales.*

12. Plants modified toward parasitism (except some *Olacaceae*), often with reduced leaves, and sometimes lacking chlorophyll; ovules (except some *Olacaceae*) more or less simplified, with only 1 or no integument; flowers often unisexual, mostly apetalous and more or less epigynous; fruit indehiscent . . . . . 23. *Santalales.*

11. Plants neither parasitic nor entomophagous.

13. Flowers mostly more or less strongly reduced and generally unisexual (perfect in some aquatic herbs, among others), individually mostly inconspicuous, often some of them borne in catkins; seeds not centrospermous.

14. Carpels and locules mostly 3 (2-4), each with 1 or 2 mostly pendulous ovules, or some locules empty; flowers not in catkins; seeds mostly endospermous (ovules erect and seeds without endosperm in *Didieraceae)*; plants mostly woody, except some *Euphorbiaceae,* with simple or occasionally compound leaves . . . . . 22. *Euphorbiales.*

14. Flowers differing in one or more respects from those of the Euphorbiales as described above, seldom tricarpellate and trilocular, and often some of them in catkins.

15. Herbs, chiefly aquatic; flowers not in catkins.

16. Submerged or more often emergent aquatics, or terrestrial herbs, with inferior or naked ovary and with endosperm . . . . . 11. *Haloragales.*

16. Submerged aquatics with superior or naked ovary and without endosperm . . . . . 12. *Podostemonales.*

15. Plants either woody, or with some of the flowers borne in catkins, or often both; mostly not aquatic.

17. Fruit indehiscent; seeds solitary or few, not comose.

18. Leaves simple or occasionally palmately compound, the forms with compound leaves mostly herbaceous or climbing.

19. Leaves alternate or opposite, more or less well developed; ovules each with a single embryo sac.

20. Leaves mostly alternate (opposite-leaved forms generally have stipules, or have more than 4 stamens); trees, shrubs, and herbs; monoecious or dioecious, or seldom with perfect flowers. 13. *Urticales.*

20. Leaves opposite, exstipulate; dioecious; stamens 4.

21. Ovary unilocular; leaves firm, not fleshy; integument 1; shrubs and small trees; endosperm well developed . . . . . 25. *Garryales.*

21. Ovary 4-locular; leaves fleshy; integuments 2; subshrubs; endosperm wanting . . . . 27. *Batidales.*

19. Leaves whorled, reduced and scale-like; ovules each with about 20 embryo-sacs; trees . . . 14. *Casuarinales.*

18. Leaves pinnately compound or trifoliate; trees . . . . . 18. *Juglandales.*

17. Fruit capsular, with numerous comose parietally attached seeds; leaves simple; trees and shrubs. 36. *Salicales.*

13. Flowers usually more or less well developed, only seldom unisexual, never borne in catkins, usually but not always petaliferous (some forms with centrospermous seeds, among others, have reduced and unisexual flowers).

22. Plants mostly with intraxylary phloem; flowers strongly perigynous to epigynous; leaves mostly opposite; stamens, if numerous, developing in centripetal sequence; placentation mostly axile, sometimes apical, rarely parietal; trees, shrubs, and herbs; seeds not centrospermous . . . 10. *Myrtales.*

22. Plants mostly without intraxylary phloem (the few exceptions limited almost entirely to the *Caryophyllales,* which have centrospermous seeds); flowers diverse, but mostly not presenting the combination of characters shown by the *Myrtales;* leaves various.

23. Seeds (except in some *Polygonaceae)* mostly centrospermous (i.e., the embryo elongate, peripheral or nearly so, and generally more or less curved around the usually copious perisperm or endosperm); placentation typically free-central or basal in a unilocular syncarpous ovary, sometimes axile, or parietal in a monocarpous ovary, rarely (some *Aizoaceae*) parietal in a syncarpous ovary; plants typically herbaceous and often more or less fleshy, less often woody . . . . . 26. *Caryophyllales.*

23. Seeds generally not centrospermous, or if more or less so (as in *Frankeniaceae* and some *Cactaceae)* then the plants mostly with parietal placentation, or differing in other respects from the *Caryophyllales.*

24. Plants mostly either with numerous stamens that (except in some *Rhœdales,* which have parietal placentation) develop in centrifugal sequence, or with parietal placentation, or both; ovules mostly several or numerous per carpel, seldom only 1 or 2; flowers without a disk.

25. Placentation mostly axile.

26. Flowers hypogynous or nearly so.

27. Calyx imbricate; pubescence seldom of stellate or peltate hairs . . . . 30. *Guttiferales.*

27. Calyx valvate; pubescence commonly of stellate or peltate hairs . . . . 32. *Malvales.*

26. Flowers more or less epigynous; calyx generally valvate; pubescence not stellate or peltate . . . . . 31. *Lecythidales.*

25. Placentation mostly parietal.

28. Plants more or less strongly succulent, generally with strongly reduced leaves, and usually evidently spiny; stamens numerous, centrifugal; petals and sepals mostly numerous; ovary mostly inferior; endosperm scanty or more often wanting . . 28. *Cactales.*

28. Plants not markedly succulent, usually with well developed leaves, and seldom spiny; petals and sepals mostly of reasonably small and definite number; stamens numerous or few; ovary superior to sometimes inferior; seeds with or without endosperm.

29. Plants mostly either herbaceous, or with distinctly compound leaves, or both, and often with myrosin cells; flowers hypogynous and mostly perfect . . 33. *Rhœadales.*

29. Plants generally differing in one or more respects from the *Rhœadales* as characterized above, very often woody and simple-leaved, or with perigynous to epigynous, often unisexual flowers, and never with myrosin cells . . . . . 35. *Bixales.*

24. Plants seldom with more than about 10 stamens (numerous in some *Linales* and *Sapindales,* and in these so far as known developing in centripetal sequence); ovules very often only 1 or 2 per carpel, but sometimes more numerous, the placentation mostly axile to basal or apical; flowers often with a disk.

30. Leaves mostly compound or dissected, or simple but evidently cleft (simple and entire in a few small families and in scattered genera).

31. Ovary superior; flowers not in umbels; nodes various.

32. Plants mostly woody, seldom herbaceous . . . . . 15. *Sapindales.*

32. Plants mostly herbaceous or nearly so . . . . . 16. *Geraniales.*

31. Ovary inferior; flowers tending to be in umbels; nodes mostly multilacunar. . . . . 17. *Umbellales.*

30. Leaves simple, entire or merely toothed.

33. Flowers mostly or less irregular (regular in the *Stackhousiaceae,* and often nearly regular in the *Malpighiaceae*), and often with the stamens or petals partly connate . . 19. *Polygalales.*

33. Flowers mostly regular or nearly so.

34. Ovary mostly superior; fruit dehiscent or indehiscent; seeds with or without endosperm.

35. Stamens basally connate, commonly 10, sometimes more numerous, or only 5 in some herbaceous Linaceae; flowers without a disk 20. *Linales.*

35. Stamens mostly free, 5 or fewer; flowers often with a disk . . . . . 21. *Celastrales.*

34. Ovary mostly inferior; fruit indehiscent; seeds endospermous. 24. *Cornales.*

10. Flowers mostly sympetalous, seldom polypetalous (*Clethraceae,* some *Ericaceae*) or apetalous (*Empetraceae,* scattered other genera); integuments often only 1.

36. Ovary mostly superior (seldom inferior, the flowers then with mostly more than 5 stamens); stamens from fewer than to more numerous than the corolla-lobes and sometimes opposite them; filaments generally separate; fruits generally with more than 1 seed (1-seeded in *Plumbaginales* and some *Primulales* and *Gentianales*); nodes mostly unilacunar (trilacunar in *Plantaginales* and *Plumbaginaceae,* multilacunar in *Menyanthaceae*).

37. Stamens (except in a few *Ericaceae* and *Styracaceae*) generally either more numerous than the corolla-lobes or isomerous and opposite the corolla-lobes (corolla apparently wanting and stamens few in *Empetraceae*); carpels (2) 3-many; no intraxylary phloem.

38. Placentation generally axile, but the partition sometimes poorly developed or even wanting; stamens diverse; integuments 1 or 2.

39. Ovules several to many per locule, rarely only 1 or 2; herbs, shrubs, or sometimes trees, chiefly extratropical or of mountainous areas in the tropics, usually of acid soil, often (?always) strongly mycorhizal and frequently evidently modified as a result, sometimes without chlorophyll, often microphyllous or sclerophyllous or both, and frequently evergreen . . . 37. *Ericales.*

39. Ovules 1-2 (8) per locule, rarely more than 2 maturing; trees or less often shrubs, chiefly tropical and subtropical, not evidently modified as a result of mycorhizal association, not microphyllous . . . 38. *Ebenales.*

38. Placentation free-central or basal in a 1-celled ovary; stamens epipetalous, opposite the corolla-lobes; integuments mostly 2.

40. Style solitary, with a capitate or slightly lobed stigma; ovules generally several, sometimes only one maturing; woody or herbaceous . . . . . 39. *Primulales.*

40. Style deeply 5-cleft, or styles 5; ovule solitary; herbs, shrubs, or vines, never trees. . . . . 29. *Plumbaginales.*

37. Stamens isomerous and alternate with the corolla-lobes, or fewer, never opposite the corolla-lobes; carpels commonly 2 (3 in most *Polemoniaceae,* several in the *Lennoaceae,* and occasionally 3 or more in other families); integument 1.

41. Seeds usually either more than 2 per carpel, or with endosperm, or both; fruit never of 4 separating nutlets.

42. Corolla regular or nearly so; stamens (*Oleaceae* excepted) generally as many as the corolla-lobes.

43. Corolla scarious, persistent; flowers 4-merous except for the bicarpellate gynoecium; nodes trilacunar; leaves typically basal; mostly herbs, without intraxylary phloem . . . . . 41. *Plantaginales.*

43. Corolla usually petaloid, not scarious; flowers seldom 4-merous; nodes mostly unilacunar (multilacunar in *Menyanthaceae*); often with intraxylary phloem.

44. Leaves chiefly opposite (*Menyanthaceae* excepted); carpels 2; plants often tropical and woody. . . . . 40. *Gentianales.*

44. Leaves chiefly alternate (many exceptions among the *Polemoniaceae*, which generally have 3 carpels, fewer exceptions among the *Hydrophyllaceae* and elsewhere); plants rarely both tropical and woody. . . . . 42. *Polemoniales.*

42. Corolla more or less strongly irregular; stamens usually fewer than the corolla-lobes; nodes mostly unilacunar (3-5-lacunar in some *Gesneriaceae*); rarely any intraxylary phloem . . . . . 43. *Scrophulariales.*

41. Seeds 2 per carpel (or fewer by abortion), without endosperm; fruit typically of 4 more or less distinct (or separating) 1-seeded nutlets; nodes unilacunar; no intraxylary phloem . . 44. *Lamiales.*

36. Ovary inferior (superior only in a few scattered genera); stamens alternate with the corolla-lobes, or fewer (fewer chiefly in herbaceous forms that either have the filaments connate into a tube or have 1-seeded fruits); integument 1 or rarely none; nodes often 3-5-lacunar, sometimes uni-lacunar; mostly without intraxylary phloem.

45. Flowers borne in various sorts of inflorescences; if borne in involucrate heads, then the ovules either pendulous or more than 1.

46. Leaves alternate, rarely opposite or seemingly whorled, usually exstipulate; stamens usually free or attached to the base of the corolla, seldom attached well

up in the tube; endosperm generally well developed; nodes unilacunar or less often 3-5-lacunar; seldom woody . . . 45. *Campanulales.*

46. Leaves nearly always opposite or whorled, often stipulate; stamens epipetalous; endosperm present or absent; nodes chiefly trilacunar, or unilacunar among many *Rubiaceae;* often woody . . . 46. *Rubiales.*

45. Flowers borne in involucrate, centripetally flowering heads; ovary 1-celled, with a solitary, erect ovule; anthers generally connate into a tube around the style; endosperm wanting; nodes mostly trilacunar or multilacunar; leaves opposite or alternate, exstipulate . . 47. *Asterales.*

Suggested linear sequence of dicot. orders and families.

I. **Ranales**

1. *Magnoliaceae.*
2. *Cercidiphyllaceae.*
3. *Winteraceae.*
4. *Trochodendraceae.*
5. *Tetracentraceae.*
6. *Himantandraceae.*
7. *Degeneriaceae.*
8. *Austrobaileyaceae.*
9. *Annonaceae.*
10. *Schizandraceae.*
11. *Illiciaceae.*
12. *Eupteliaceae.*
13. *Ranunculaceae.*
14. *Nymphaeaceae.*
15. *Ceratophyllaceae.*

II. **Dilleniales**

16. *Dilleniaceae.*
17. *Paeoniaceae.*
18. *Crossosomataceae.*

III. **Berberidales**

19. *Berberidaceae.*
20. *Circaeasteraceae.*
21. *Lardizabalaceae.*
22. *Menispermaceae.*
23. *Coriariaceae.*
24. *Corynocarpaceae.*
25. *Sabiaceae.*

IV. **Aristolocholiales**

26. *Aristolochiaceae.*

V. **Laurales**

27. *Amborellaceae.*
28. *Monimiaceae.* *(incl. Trimenia).*
29. *Lactoridaceae.*
30. *Gomortegaceae.*
31. *Lauraceae.*
32. *Hernandiaceae.*
33. *Calycanthaceae.*
34. *Eupomatiaceae.*
35. *Myristicaceae.*

VI. **Canellales**

36. *Canellaceae.*

VII. **Piperales**

37. *Saururiaceae.*
38. *Piperaceae.*
39. *Chloranthaceae.*

VIII. **Rosales**

40. *Connaraceae.*
41. *Cunoniaceae.*
42. *Hamamelidaceae.*
43. *Myrothamnaceae.*
44. *Hydrangeaceae.*
45. *Grossulariaceae.*
(incl. Escalloniaceae).
46. *Pittosporaceae.*
47. *Bruniaceae.*
48. *Crassulaceae.*
49. *Cephalotaceae.*
50. *Saxifragaceae.*
51. *Rosaceae.*
52. *Leguminosae.*
53. *Krameriaceae.*

IX. **Proteales**

54. *Elaeagnaceae.*
55. *Proteaceae.*

X. **Myrtales**

56. *Heteropyxidaceae.*
57. *Sonneratiaceae.*
58. *Geissolomataceae.*
59. *Crypteroniaceae.*
60. *Lythraceae.*
61. *Peneaceae.*
62. *Thymeleaceae.*
63. *Hydrocaryaceae.*
64. *Dialypetalanthaceae.*
65. *Myrtaceae.*
66. *Punicaceae.*
67. *Oliniaceae.*
68. *Onagraceae.*
69. *Melastomataceae.*
70. *Combretaceae.*

XI. **Haloragales**

71. *Gunneraceae.*
72. *Haloragaceae.*
73. *Hippuridaceae.*
74. *Callitrichaceae.*

XII. **Podostemonales**

75. *Podostemonaceae.*
76. *Hydrostachyaceae.*

XIII. **Urticales**

77. *Leitneriaceae.*
(incl. Didymeles?)
78. *Platanaceae.*
79. *Urticaceae.*
80. *Myricaceae.*
81. *Moraceae.*
82. *Ulmaceae.*
83. *Barbeyaceae.*
84. *Betulaceae.*
85. *Fagaceae.*
86. *Eucommiaceae.*
87. *Balanopsidaceae.*

XIV. **Casuarinales**

88. *Casuarinaceae.*

XV. **Sapindales**

89. *Staphyleaceae.*
90. *Melianthaceae.*
91. *Greyiaceae.*
92. *Akaniaceae.*
93. *Bretschneideriaceae.*
94. *Sapindaceae.*
95. *Hippocastanaceae.*
96. *Aceraceae.*
97. *Anacardiaceae.*
98. *Burseraceae.*
99. *Simaroubaceae.*
100. *Cneoraceae.*
101. *Rutaceae.*
102. *Meliaceae.*
103. *Zygophyllaceae.*

XVI. **Geraniales**

104. *Oxalidaceae.*
105. *Geraniaceae.*
106. *Limnanthaceae.*
107. *Tropaeolaceae.*

XVII. **Umbellales**

108. *Araliaceae.*
109. *Umbelliferae.*

XVIII. **Juglandales**

110 *Picrodendraceae.*
111. *Rhoipteleaceae.*
112. *Julianaceae.*
113. *Juglandaceae.*

XIX. **Polygalales**

114. *Malpighiaceae.*
115. *Trigoniaceae.*
116. *Vochysiaceae.*
117. *Balsaminaceae.*
118. *Stackhousiaceae.*
119. *Tremandraceae.*
120. *Xanthophyllaceae.*
121. *Polygalaceae.*

XX. **Linales**

122. *Humiriaceae.*
123. *Erythroxylaceae.*
124. *Linaceae.*

XXI. **Celastrales**

125. *Rhamnaceae.*
126. *Vitaceae.*
127. *Celastraceae.*

128. *Hippocrateaceae.*
129. *Salvadoriaceae.*
130. *Dichapetalaceae.*
131. *Aquifoliaceae.*
132. *Icacinaceae.*

XXII. **Euphorbiales**

133. *Buxaceae.*
134. *Euphorbiaceae.*
135. *Daphniphyllaceae.*
136. *Aextoxicaceae.*
137. *Pandaceae.*
138. *Didieraceae.*

XXIII. **Santalales**

139. *Olacaceae.*
140. *Opiliaceae.*
141. *Santalaceae.*
142. *Myzodendraceae.*
143. *Loranthaceae.*
144. *Mitrastemonaceae.*
145. *Hydnoraceae.*
146. *Rafflesiaceae.*
147. *Balanophoraceae.*

XXIV. **Cornales**

148. *Rhizophoraceae.*
149. *Cornaceae.*
150. *Alangiaceae.*
151. *Nyssaceae.*
152. *Grubbiaceae.*

XXV. **Garryales**

153. *Garryaceae.*

XXVI. **Caryophyllales**

154. *Phytolaccaceae.*
155. *Nyctaginaceae.*
156. *Aizoaceae.*
157. *Portulacaceae.*
158. *Basellaceae.*
159. *Caryophyllaceae.*
160. *Chenopodiaceae.*
161. *Amaranthaceae.*
162. *Polygonaceae.*
163. *Thelygonaceae.*

XXVII. **Batidales**

164. *Batidaceae.*

XXVIII. **Cactales**

165. *Cactaceae.*

XXIX. **Plumbaginales**

166. *Plumbaginaceae.*

XXX. **Guttiferales**

167. *Caryocaraceae.*
168. *Eucryphiaceae.*
169. *Quiinaceae.*
170. *Elatinaceae.*
171. *Medusaginaceae.*
172. *Guttiferae.*
173. *Hypericaceae.*
174. *Ochnaceae.*
175. *Chlaenaceae.*
176. *Dipterocarpaceae.*
177. *Theaceae.*
178. *Cyrillaceae.*
179. *Stachyuraceae.*
180. *Actinidiaceae.*
181. *Marcgraviaceae.*

XXXI. **Lecythidales**

182. *Lecythidaceae.*

XXXII. **Malvales**

183. *Elaeocarpaceae.*
184. *Tiliaceae.*
185. *Buettneriaceae.*
186. *Sterculiaceae.*
187. *Scytopetalaceae.*
188. *Bombacaceae.*
189. *Malvaceae.*

XXXIII. **Rhoeadales**

190. *Tovariaceae.*
191. *Papaveraceae.*
192. *Fumariaceae.*
193. *Moringaceae.*
194. *Capparidaceae.*
195. *Cruciferae.*
196. *Resedaceae.*

XXXIV. **Sarraceniales**

197. *Byblidaceae.*
198. *Droseraceae.*
199. *Sarraceniaceae.*
200. *Nepenthaceae.*

XXXV. **Bixales**

201. *Dioncophyllaceae.*
202. *Flacourtiaceae.*
203. *Bixaceae.*
204. *Cistaceae.*
205. *Violaceae.*
206. *Tamaricaceae.*
207. *Frankeniaceae.*
208. *Samydaceae.*
209. *Turneraceae.*
210. *Loasaceae.*
211. *Passifloraceae.*
212. *Malesherbiaceae.*
213. *Fouquieriaceae.*

214. *Hoplestigmataceae.*
215. *Caricaceae.*
216. *Achariaceae.*
217. *Begoniaceae.*
218. *Datiscaceae.*
219. *Cucurbitaceae.*
220. *Ancistrocladaceae.*

XXXVI. **Salicales**

221. *Salicaceae.*

XXXVII. **Ericales**

222. *Clethraceae.*
223. *Ericaceae (sens. lat.)*
224. *Epacridaceae.*
225. *Diapensiaceae.*
226. *Empetraceae.*

XXXVIII. **Ebenales**

227. *Styracaceae.*
228. *Ebenaceae.*
229. *Sapotaceae.*

XXXIX. **Primulales**

230. *Theophrastaceae.*
231. *Myrsinaceae.*
232. *Primulaceae.*

XL. **Gentianales**

233. *Buddleiaceae.*
234. *Oleaceae.*
235. *Menyanthaceae.*
236. *Gentianaceae.*
237. *Loganiaceae.*
238. *Apocynaceae.*
239. *Asclepiadaceae.*

XLI. **Plantaginales**

240. *Plantaginaceae.*

XLII. **Polemoniales**

241. *Polemoniaceae.*
242. *Hydrophyllaceae.*
243. *Solanaceae.*
244. *Convolvulaceae.*
245. *Cuscutaceae.*
246. *Lennoaceae.*

XLIII. **Scrophulariales**

247. *Scrophulariaceae.*
248. *Myoporaceae.*
249. *Selaginaceae.*
250. *Gesneriaceae.*
251. *Columelliaceae.*
252. *Orobanchaceae.*
253. *Bignoniaceae.*
254. *Acanthaceae.*
255. *Pedaliaceae.*
256. *Lentibulariaceae.*

XLIV **Lamiales**

257. *Boraginaceae.*
258. *Verbenaceae.*
259. *Phrymaceae.*
260. *Labiatae.*

XLV. **Campanulales**

261. *Campanulaceae.*
262. *Goodeniaceae.*
263. *Stylidiaceae.*
264. *Calyceraceae.*

XLVI. **Rubiales**

265. *Rubiaceae.*
266. *Caprifoliaceae.*
267. *Adoxaceae.*
268. *Valerianaceae.*
269. *Dipsaceae.*

XLVII. **Asterales**

270. *Compositae.*

BIBLIOGRAPHY

Bailey, I. W., & B. G. L. Swamy, 1951. The conduplicate carpel of dicotyledons and its initial trends of specialization. *Am. Jour. Bot.* 38 : 373-379.

Bessey, C. E. 1915. The phylogenetic taxonomy of flowering plants. *Ann. Mo. Bot. Gard.* 2 : 109-164.

Brown, W. H. 1938. The bearing of nectaries on the phylogeny of flowering plants. *Proc. Am. Phil. Soc.* 79 : 549-595.

Buxbaum, F. 1948. Zur Klaring der phylogenetischen Stellung der *Aizoaceae* und *Cactaceae* im Pflanzenreich. *Jahrb. Schweiz. Kakt.-Ges.* 1948 : 3-16. 1949. Vorläufer des Kakteen-Habitus bei den *Phytolaccaceen. Oesterr. Bot. Zeits.* 96 : 5-14.

CHAPMAN, M. 1936. Carpel anatomy of the *Berberidaceae*. *Am. Jour. Bot.* 23 : 340-348.

COPELAND, H. F. 1935. The structure of the flower of *Pholisma arenarium*. *Am. Jour. Bot.* 22 : 366-383.
1938. The *Styrax* of northern California and the relationships of the *Styracaceae*. *Am. Jour. Bot.* 25 : 771-780.

CORNER, E. J. H. 1946. Centrifugal stamens. *Jour. Arn. Arb.* 27 : 423-437.

CRONQUIST, A. 1955. Phylogeny and taxonomy of the *Compositae*. *Am. Midl. Nat.* 53 : 478-511.

EAMES, A. 1951. Again : The new morphology. *New Phyt.* 50 : 17-35.
1953. Floral anatomy as an aid in generic limitation. *Chron. Bot.* 14 : 126-132.

EDLIN, H. L. 1935. A critical revision of certain taxonomic groups of the *Malvales*. *New Phyt.* 34 : 1-20; 122-143.

ERDTMAN, G. 1952. Pollen morphology and plant taxonomy. Angiosperms. Stockholm. Almqvist & Wiksell.

FAGERLIND, F. 1947. Gynöceummorphologische und embryologische Studien in der Familie *Olacaceae*. *Bot. Not.* Lund. 1947 : 207-230.

FAHN, A., & I. W. BAILEY. 1957. The nodal anatomy and the primary vascular cylinder of the *Calycanthaceae*. *Journ. Arn. Arb.* 38 : 107-117.

FRIEDRICH, H. C. 1956. Studien über die natürliche Verwandtschaft der *Plumbaginales* und *Centrospermae*. *Phyton* 6 : 220-263.

GIBBS, R. D. 1945. Comparative chemistry as an aid to the solution of problems in systematic botany. *Trans. Roy. Soc. Can.* III. 39 (5) : 71-103.

GREGORY, W. C. 1941. Phylogenetic and cytological studies in the *Ranunculaceae*. *Trans. Am. Phil. Soc.* II. 31 : 443-521.

GUNDERSEN, A. 1950. Families of dicotyledons. Waltham, Mass. Chronica Botanica Co.

HAGERUP, O. 1946. Studies on the *Empetraceae*. *K. Danske Vidensk. Selsk. Biol. Meddel.* 20 (5) : 1-49.

HAMMOND. H. D. 1955. Systematic serological studies in *Ranunculaceae*. *Serol. Mus. Bull.* 14 : 1-3.

HEIMSCH, C. 1942. The « *Gruinales* » and « *Terebinthales* » of Wettstein with reference to taxonomic grouping. *Lilloa* 8 : 83-198.

HOAR, C. S. 1915. A comparison of the stem anatomy of the cohort *Umbelliflorae*. *Ann. Bot.* 29 : 55-63.

HUTCHINSON, J. 1926. The families of flowering plants. I. Dicotyledons. London. Macmillan.
1934. The families of flowering plants. II. Monocotyledons. London. Macmillan.
1948. British flowering plants. London. P. R. Gawthorn.

JØRGENSON. C. A. 1923. Studies on *Callitrichaceae*. *Bot. Tidskr.* 38 : 81-126.
1925. Zur Frage der systematischen Stellung der Callitrichaceen. *Jahrb. f. wiss. Bot.* 64 : 440-442.

LAM, H. J. 1948. A new system of the Cormophyta. *Blumea* 6 : 282-289.

MAHESHWARI, P. 1950. An introduction to the embryology of angiosperms. New York. McGraw-Hill.

MANNING, W. E. 1938. The morphology of the flowers of the *Juglandaceae*. I. The inflorescence. *Am. Jour. Bot.* 25 : 407-419.
1940. The morphology of the flowers of the *Juglandaceae*. II. The pistillate flowers and fruit. *Am. Jour. Bot.* 27 : 839-852.
1948. The morphology of the flowers of the *Juglandaceae*. III. The staminate flowers. *Am. Jour. Bot.* 35 : 606-621.

MARTIN, A. C. 1946. The comparative internal morphology of seeds. *Am. Midl. Nat.* 36 : 513-660.

Mauritzon, J. 1934. Zur Embryologie der *Elaeocarpaceae*. *Ark Bot.* 26A (10) : 1-8. 1939a. Contributions to the embryology of the orders *Rosales* and *Myrtales*. *Lunds Univ. Arsskr.* Avd. 2. 35 (2) : 1-120.
1939b. Die Bedeutung der embryologischen Forschung für das natürliche System der Pflanzen. *Lunds Univ. Arsskr.* Avd. 2. 35 (15) : 1-70.

Metcalfe, C. R., and L. Chalk. 1950. Anatomy of the dicotyledons. 2 vols. Oxford. The Clarendon Press.

Moseley, M. F. Jr. 1948. Comparative anatomy and phylogeny of the *Casuarinaceae*. *Bot. Gaz.* 110 : 232-280.

Moseley, M. F. Jr., & R. M. Beeks. 1955. Studies of the *Garryaceae*. I. The comparative morphology and phylogeny. *Phytomorph.* 5 : 314-346.

Prichard, E. C. 1955. Morphological studies in *Rhamnaceae*. *Jour. Elisha Mitchell Soc.* 71 : 82-106.

Reed, C. F. 1955. Comparative morphology of the *Olacaceae, Opiliaceae,* and *Octoknemataceae*. *Mem. Soc. Brot.* 10 : 29-79.

Samuelsson, G. 1913. Studien uber die Entwicklungsgeschichte einiger *Bicornes*-Typen. *Svensk. Bot. Tidskr.* 7 : 97-188.

Smith, F. H., and E. C. Smith. 1942. Floral anatomy of the *Santalaceae* and some related forms. *Oreg. State Monogr. Stud. Bot.* 5 : 1-93.

Soo', R. 1953. Die modernen Grundsätze der Phylogenie im neuem System der Blütenpflanzen. *Act. Biol. Hungar.* 4 : 257-306.

Stern, W. L. 1952. The comparative anatomy of the Xylem and the phylogeny of the *Julianaceae*. *Am. Jour. Bot.* 39 :220-229.

Tippo, O. 1938. Comparative anatomy of the *Moraceae* and their presumed allies. *Bot. Gaz.* 100 : 1-99.

Tournay, R., and A. Lawalrée. 1952. Une classification nouvelle des familles appartenant aux ordres des *Ligustrales* et des *Contortées*. *Bull. Soc. Bot. Fr.* 99 : 262-263.

Vestal, P. A. 1937. The significance of comparative anatomy in establishing the relationships of the *Hypericaceae* to the *Guttiferae* and their allies. *Phil. Jour. Sci.* 64 : 199-256.

Warburg, E. F. 1938. Taxonomy and relationships in the *Geraniales* in the light of their cytology. *New Phyt.* 37 : 150-159; 189-210.

Withner, C. L. 1941. Stem anatomy and phylogeny of the *Rhoipteleaceae*. *Am. Jour. Bot.* 28 : 872-878.

Worsdell, W. C. 1908. The affinities of *Paeonia*. *Jour. Bot.* 46 : 114-116.

WIND AUTOGAMY IN ARBUTUS

BY

O. HAGERUP.

In textbooks all over the world the pollination of *Bicornes* has long served as a typical example of ingenious and indispensable entomogamy. In regions where insects are plentiful, the frequency of insect visits to the beautiful, fragrant flowers, which usually contain ample nectar, has supported this well-known hypothesis.

Notwithstanding the apparent obviousness of e.g. the biological significance of the horns, the tenability of this elementary knowledge may appear to be questionable when one visits arctic regions where there are few or no insects to pollinate the untold billions of *Bicornes* flowers that adorn the heaths in e. g. Greenland, Northern Iceland or the Faroe Islands. Yet, fruits develop in such profusion that even polar bears find it worthwhile to gather berries of *Vaccinium uliginosum* whose flowers have not been visited by insects.

This is particularly pronounced in the Faroe Islands where this plant fructifies with almost automatic certainty, although there are neither butterflies, honey-bees nor bumble-bees to pollinate the flowers. Similar observations can be made of *Erica cinerea* (and *Calluna*). The inadequacy of the above-mentioned theory is particularly evident in *Phyllodoce coerulea* (in Greenland) whose anthers, though they have no horns, develop ample fruit in localities where the flower is not visited by insects.

But even *Bicornes* species in more southerly regions with plenty of insects may occasionally develop fruits under conditions where insect visits are prevented, for instance by cultivation under glass. This can be observed in some *Erica (E. arborea)* and *Arbutus*

species in Southern Europe. Such species are cultivated successfully in hothouses in Copenhagen where these observations have been made.

Arbustus has a transparent corolla through which about 10 drops of nectar are visible from the outside, attached at the base by very hairy filaments. However, the corolla is so deep that bees are unable to reach the honey with their relatively short proboscis.

Yet, it is an established fact that in nature (Mediterranean area) *Arbutus unedo* is pollinated by insects (KNUTH). Occasionally pollen may probably also be carried from one flower to another (by wind ?). The occurrence of natural hybrids between *A. unedo* and *A. andrachne* also shows that autogamy is not the only possible method of pollination. On the other hand, it was shown above that entomogamy can be dispensed with altogether.

The easiest way of ascertaining how the plant can pollinate itself is to make a median longitudinal section through the flower at various stages of development :

Fig. 1, B shows the structure of an expanded flower whose filaments (finely dotted) are of special interest. Attached to the base, the filaments are so thin that they can be forced inward against the style by the pressure of a ring-shaped swollen pad around the base of the corolla. The filaments, which are also very swollen where they face the thickest part of the corolla, are pressed towards the nectary by the pad. For these mechanical reasons, the stamens are tightly secured and pressed very closely against the style.

Fig. 1, A, D show that the corolla is quite narrow before it opens. Consequently, the anthers are also forced very closely against the style, and they remain in that position also in the open flower because the filaments are remarkably stiff and are fixed in the above-mentioned position by the pressure exerted on their swollen base.

The filaments taper off towards the point. This makes room for the anthers to move up and down, but they cannot move sideways because they are pressed firmly together into a short tube (almost as in *Compositae*).

Fig. 1, A shows a median longitudinal section of a bud just before it opens. A comparison between Fig. 1, A and Fig. 2, B reveals, in addition to the above features, that the flower undergoes other important changes of great biological significance just before it opens : the filaments are S-shaped, bent at the point (Fig. 1, A), and the two horns point either down or in towards the style. Near

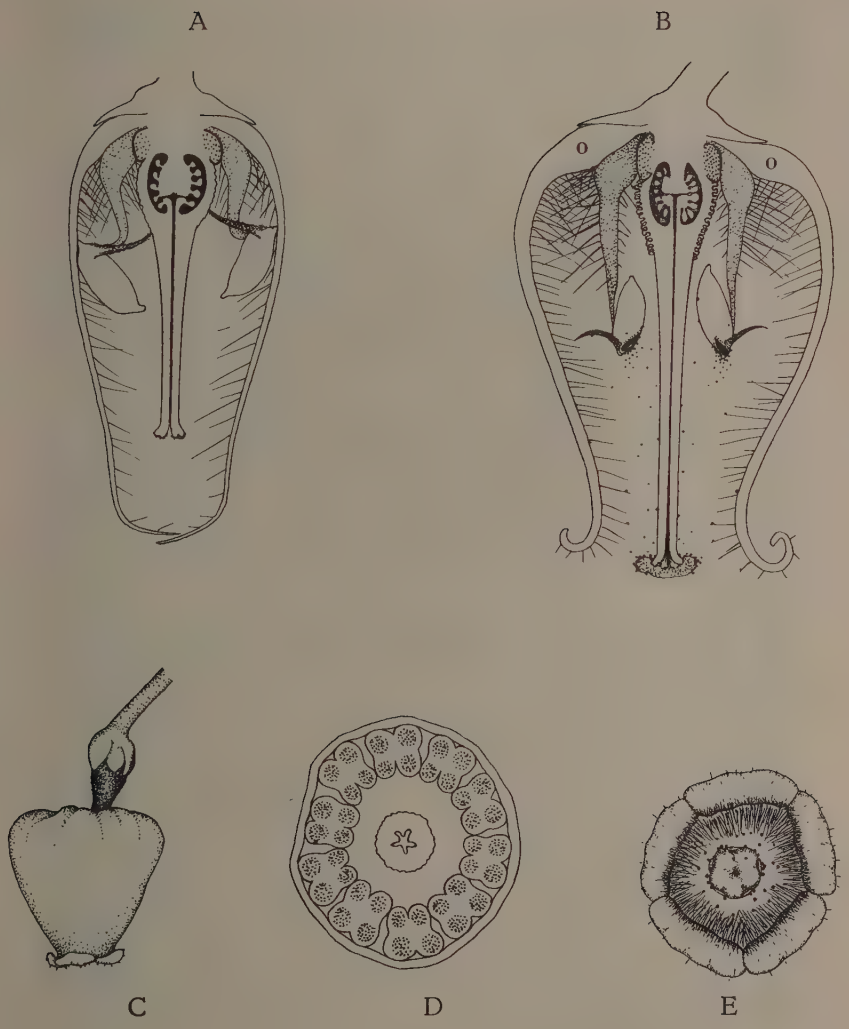


Fig. 1. — A. *Arbutus unedo :* Longitudinal section of bud. Finely dotted filaments, bent in S-shape. Nectary coarsely dotted (× 6); B, *A. unedo :* Longitudinal section of expanded flower pollinated by falling pollen. Filaments finely dotted. O : pad around the base of the corolla forces the stamens into position across the stigma (× 6); C, *A. andrachne :* Wilting : the falling corolla remains suspended half-way down the style (× 2); D, *A. unedo :* Cross-section of bud. Anthers pressed together into a tube around the style (× 12); E, *A. andrachne :* Front view of pollinated flower. Only narrow passage for pollen between the stigma and the hairs of the corolla (× 6).

the base of the horns is the place where the anthers will later open up with pits. This, in turn, means that if the anthers were to open in the position they have in the bud, the pollen would fall into the bottom of the flower and be lost among hairs and nectar.

In the bud, the anthers are held firmly in position by the narrow corolla (Fig. 1, A) but when the corolla opens it becomes much wider at the very place where the anthers were clamped up. At the time when the anthers are released, the filaments suddenly straighten out, wither at the point, while the anthers — as a result hereof — make a remarkable vertical bend of 180 degrees so that the lower part now faces upward. This great turn makes the horns face outward with the result that the pores face the opening of the corolla in the open flower.

When the corolla opens, the style grows so much in length that the stigma is placed like a stopper in the narrow opening of the corolla (Fig. 1, E). Now the flower can be pollinated and the stigma is covered with a thick layer of mucilage to hold the pollen which soon begins to germinate and sends long pollen tubes down through a narrow channel (Figs. 1, A, B and D) in the centre of the style.

When the corolla expands the anthers likewise open; but pollen will not begin to fall in a steady flow from the drooping flower unless the latter is constantly being shaken. If, for instance, cut flowers are placed under a glass case, no pollen will drop out through the fine pores of the anthers; it is like a pepperbox with fine holes : if it is not shaken, it will yield no pepper.

If the plant is shaken by *wind*, rain (or by human beings passing it), the openings of the flowers will soon look as shown in Fig. 1, E because pollen may stick to any part of the hairy inner side of the corolla. But the pollen grains thus stranded can easily be shaken off the hairs again; they will then continue the fall towards the opening of the corolla — to the very place where the stigma is. Fig. 1, B and E show that the hairs reduce the risk of pollen falling past the stigma and being lost. But even pollen floating in the air has a chance — though a small one — of being carried to the stigma of another flower (anemogamy).

As a result of all these adjustments, a considerable amount of pollen will be left on the broad lump of mucilage on the stigma, provided that the flower has been constantly shaken. The broad leaves, serving as a *wind scoop* by being directed upward round the whole inflorescence, also help to ensure that the flower is

shaken. Other wind-autogamous relatives, e.g. *Arctostaphylos, Andromeda,* etc., have similar arrangements.

The flower has still one last and remarkable chance of self-pollination when the principal phase of the flowering is over and the corolla begins to wither : the calyx — originally radiating horizontally (Figs. 1, A and B) — suddenly turns upward (Fig. 1, C), thereby exerting so heavy a pressure against the bottom of the corolla that the latter is torn from its base and slips off along the rigid style (Fig. 1, C). During this movement, the stamens are still fixed on the inside of the corolla and the anthers form a tube round the style. The stamen-tube will finally slip off the tip of the style where the stigma is, thus getting rubbed by the anthers on which there is still some pollen left.

In this process it is essential that the anthers should not be bent too far out and away from the style. This is prevented by the horns which, in any such undesirable movement, would be stopped by the inside of the corolla. *The most important biological function of the horns is perhaps the very fact that they help to keep the anthers in position across the stigma,* which will thus be in the best place to be hit by falling pollen. Incidentally, the latter is particularly heavy because the pollen grains stick together in tetrads. The fact that horns are missing in species where they are superfluous, because the opening or the sides of the corolla force the anthers directly into the optimal position across the stigma, may be cited as additional evidence to indicate that the most essential purpose of the horns is to keep the anthers, and consequently the flow of falling pollen, as closely as possible across the stigma. This is the case in e.g. *Phyllodoce, Erica carnea,* and many South-African *Erica* species with narrow corolla.

When the anthers get into contact with the still mucilaginous stigma the falling corolla sometimes remains suspended half-way down the style in the strange position shown in Fig. 1, C. This happens occasionally in most of our other *Bicornes* with drooping flowers. Høeg (1925) was the first to observe this remarkable phenomenon (at Spitzbergen) in *Cassiope tetragona* where it is particularly in evidence.

An insect visit will usually be *too late,* because the flower's own pollen begins to fall very early. Moreover, the insect will not deposit pollen in the same quantities as the flower produces itself.

In its natural habitats (the Mediterranean area) *Arbutus* is in flower during the rainy (winter) season. However, the corolla

is markedly impervious to water, and if the flowers are exposed to artificial rain (sprinkling) the water gathers in small spherical drops which soon trickle down the flowers without forming large drops that could settle e.g. on the opening of the corolla and stop it. The rain shakes the flower and accelerates the flow of falling pollen. Hence, the tightly closed corolla prevents pollen from being carried away or destroyed by wind or rain, thus forming a protective cover around the ingenious mechanism of wind autogamy.

Both *Arbutus* and all our domestic *Bicornes* develop fruits even if insects visits are prevented, for instance by means of bags tied over the flowers. We shall probably find that the biological mechanism operating in the flowering of *Arbutus* in nature will not be very different from that observed in the hothouse as reported here.

The structural features discussed above, which, in *Arbutus*, represent adaptations to wind autogamy, can be seen with only immaterial variations in most of the other drooping *Bicornes* flowers examined (Hagerup, 1954). *Arbutus* may therefore be regarded as a biological average type among the many similar *Ericaceae* flowers which occur in most parts of the world and may show biological conditions of pollination that are not essentially different from those described above. *Wind autogamy is the safest and most frequent method of pollination*, but anemogamy and entomogamy may occur side by side with it, though the importance of the latter two methods is generally much exaggerated and many species can dispense with insect visits altogether.

SUMMARY.

The drooping urceolate flower of Arbutus and of many other Bicornes is not specially adapted to entomogamy but, on the contrary, to wind autogamy.

The stigma is located near the narrow opening of the corolla. All pollen shaken off the anthers must pass this opening.

The anthers are forced across the stigma in an optimal position for pollination. This position derives from an inward pressure exerted on the base of the filament (Fig. 1, B). *The horns of the anthers prevent the latter from bending out* towards the corolla.

The large pollen grains can only pass the fine pores in the anthers when the flower is being *constantly* shaken by wind, etc. Such shaking releases a steady flow of pollen down accross the mucilaginous lump on the stigma.

Hairs inside the corolla reduce the risk of pollen falling outside the stigma (Fig. 1, E).

The water-repellant corolla prevents rain (or wind) from wasting pollen.

Insect visits depend on chance; they can often be dispensed with, and the *flower will generally have pollinated itself before an insect arrives.*

The wilting flower has a last chance of pollination when the corolla, with the stamens attached to it, slides down along the style and the stigma (Fig. 1, C). The corolla is detached by the great force with which the calyx, originally distended horizontally, turns upward.

LITERATURE.

Hagerup, O., Thrips Pollination in *Calluna*. *Kgl. Danske Vidensk. Selskab Biol. Medd.*, 18, n° 4, pp. 1-16 (1950).

— , Pollination in the Faroes in spite of rain and poverty in insects. *Kgl Danske Vidensk. Selskab. Biol. Medd.*, 18, n° 15, pp. 1-48 (1951).

— , Autogamy in some Drooping *Bicornes* Flowers. *Botanisk Tidsskrift* 51, pp. 103-116 (1954).

Hagerup, E. and O., Thrips Pollination in *Erica tetralix*. New Phytologist, 52, pp. 1-7 (1953).

Höeg, O. A., Blomsterbestøvningen på Spitsbergen. *Naturen*, pp. 202-220, Bergen (1925).

Knuth, P., Handbuch der Blütenbiologie. II, 2, pp. 28-56, Leipzig (1898-99).

Nordhagen, R., Studien über die monotypische Gattung *Calluna* Salisb. *Bergens Museums Arbok. Naturvidensk. Rekke*, 4, 1, pp. 1-42 and 1-70 (1937-38).

Warming, E., *Ericaceae*, Arctic Flowering Plants, I, pp. 1-71, and *Medd. over Grønl.*, 36 (1908).

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DISCOVERY OF ALTERNANTHERA (AMARANTHACEAE) IN THE NATIVE HAWAIIAN FLORA.

Hawaiian plant studies 27 (1)

BY

Harold St. JOHN,

Honolulu.

Up to the present the Amaranthaceae has been represented in the native Hawaiian flora by herbaceous species of *Achyranthes,* and woody species of the Polynesian *Charpentiera,* and of the endemic *Nototrichium.* Below is described as a new species of *Alternanthera,* a species collected in the Sandwich Islands by Archibald Menzies in 1792-94. It was presumably found in the arid lowlands on the leeward (southwestern) side of one of the larger islands of the group, now known as the Hawaiian Islands.

Alternanthera Menziesii St. John, sp. nov. — Fig. 2.

Herba, ramulis 3 mm diametro teretibus vetustioribus brunneis glabris sublucidis striatis junioribus 1 mm diametro valde striatis

(1) This is the twenty-seventh of a series of papers designed to present descriptions, revisions, and records of Hawaiian plants. The preceding papers have been published in *B. P. Bishop Mus., Occ. Papers,* **10** (4), 1933; **10** (12), 1934; **11** (14), 1935; **12** (8), 1936; **14** (8), 1938; **15** (1), 1939; **15** (2), 1939; **15** (22), 1940; **15** (28), 1940; **17** (12), 1943; *Calif. Acad. Sci., Proc.,* IV, **25** (16), 1956; *Torrey Bot. Club, Bul.,* **72** : 22-30, 1945; *Lloydia,* **7** : 265-274, 1944; *Pacif. Sci.,* **1** (1) : 5-20, 1947; *Brittonia,* **6** (4) : 431-499, 1949; *Gray Herb., Contrib.,* **165** : 39-42, 1947; *Pacif. Sci.,* **3** (4) : 296-301, 1949; **4** (4) : 339-345, 1950; *B. P. Bishop Mus., Occ. Papers,* **20** (6), 1950; *Pacif. Sci.,* **6** (1) : 30-34, 1952; **6** (3) : 213-255, 1952; **8** (2) : 140-146, 1954; *Polynes. Soc. Jour.,* **63** (1) : 27-34, 1954; *B. P. Bishop Mus., Occ. Papers,* **21** (15), 1955; (Nos. 25-26 are in press).

et adpresse adscendenti-puberulentis, internodis 1-7.2 cm longis, *foliis* oppositis, petiolis 1-2 mm longis adpressi-strigulosis, laminis 1-3.2 cm longis 3.5-6.5 mm latis lanceo-linearibus cuneatis integris crasse chartaceis opaquis pinnato-nervosis supra adpresse strigosis infra dense adpresse strigosis, *inflorescentiis* capitatis sessilibus terminalibus multi-floriferis 10-13 mm diametro, bracteis florae 2-3 floribus simulantibus sed dimidiis vel minus quam sepalas et exteriore minima, *sepalis* eburneis 5 inaequalibus exteriore minimo et 5/6 tam longa quam interiora omnibus rigidis et cartilagineis anguste lineari-lanceolatis ad basim hirsutulis apicibus recurvatis, sepala interiore 7,3 mm longa, 0.9-1 mm lata marginibus ad basim membranaceis, *tubo filamentis* membranaceis 5-6 mm longis, apicibus filamentis liberatis 0.3 mm longis in sinu affixis, pseudostaminodiis 5 integris 1.7 mm longis, 0.3 mm latis ligulatis acutis, antheris 5 linearibus 1.4 mm longis 0.1 mm latis 2-loculatis longitudinaliter dehiscentibus, *ovario* ovoideo breve rostrato, ovula 1 basali funiculo longo, stigma capitata, *fructubus* incognitis.

Herb, perhaps prostrate with stem tips assurgent, or the four branches preserved might be lateral branches of an erect herb; branches as much as 3 mm in diameter, terete, the older ones brown, glabrous, smooth, somewhat shiny, longitudinally striate; young branchlets about 1 mm in diameter, appressed ascending puberulent, prominently striate; internodes 1-7.2 cm long; *leaves* opposite; petioles 1-2 mm long, appressed strigulose; blades 1-3.2 cm long, 3.5-6.5 mm wide, lance-linear, obtuse, entire, thick chartaceous, opaque, pinnately nerved, appressed strigose above and densely so below, pinnately nerved, cuneate at base; *inflorescences* capitate, sessile, terminal, many-flowered, 10-13 mm in diameter; flower subtended by 2-3 bracts similar to but less than half the length of the perianth parts, the bracts reducing in size to the outer smallest one; *perianth parts* 5, ivory-colored, unequal, the innermost the larger, the outermost the smaller, about 5/6 the length of the longest, all rigid and cartilaginous with spreading tips, narrowly linear-lanceolate, near the base with a few small patches hirsutulous, the innermost 7.3 mm long, 0.9-1 mm wide, the lower margins membranous; *filament tube* membranous 5-6 mm long; filament tips free 0.3 mm long, from the base of a deep sinus; alternating with the five stamens are ligulate, entire, acute, membranous lobes or pseudostaminodia 1.7 mm long, 0.3 mm wide; the 5 anthers 1.4 mm long, 0.1 mm wide, linear, 2-celled, longitudinally dehiscent;

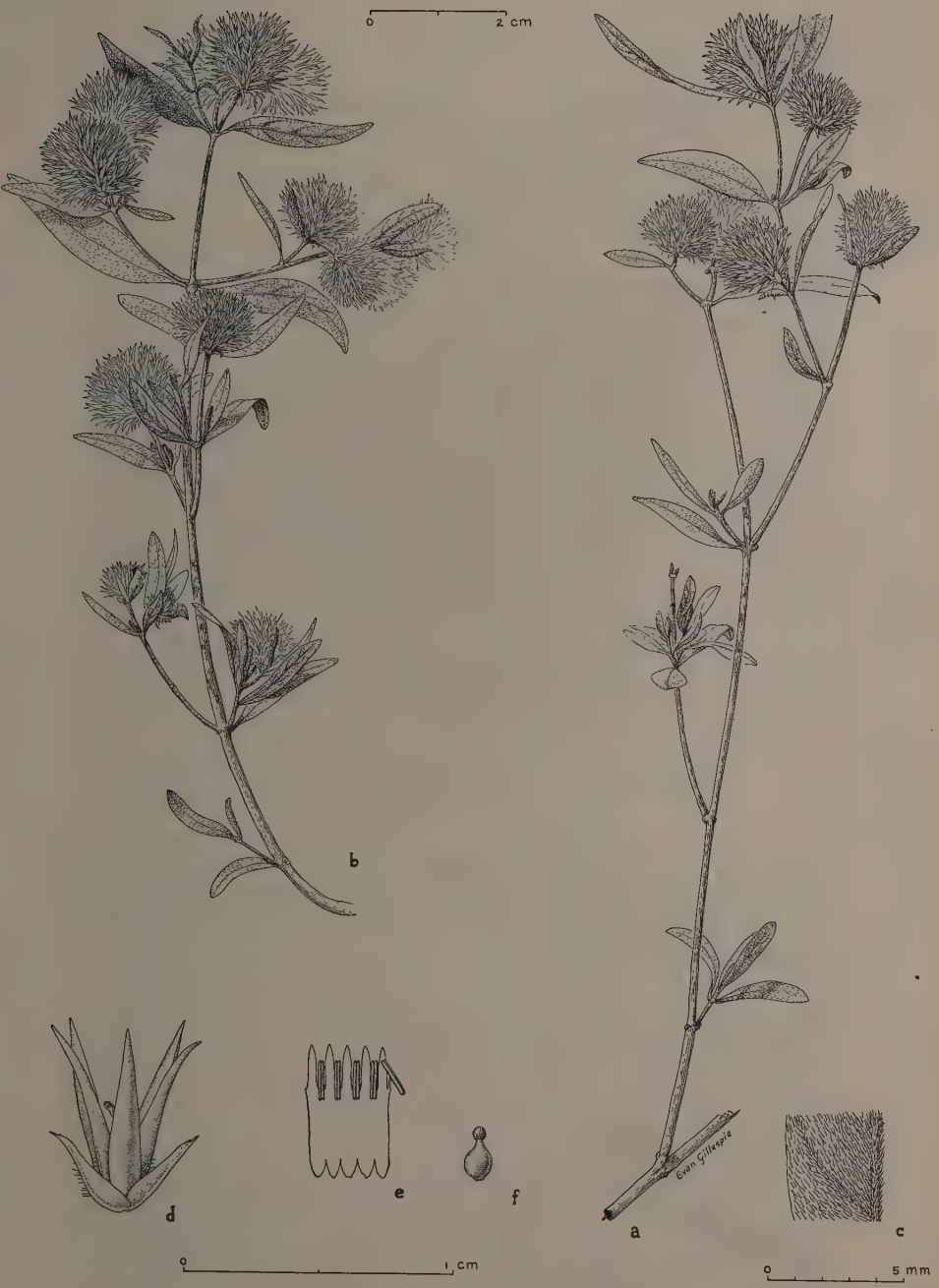

Fig. 2. — *Alternanthera Menziesii* St John : a, b, habit (× 1); c, blade, lower side (× 4); d, flower (× 4); e, androecium opened flat (× 4); f, pistil (× 4). — From holotype.

ovary ovoid, short beaked; ovule 1, basal on a long funiculus; stigma capitate; *fruit* unknown.

Holotypus : Sandwich Islands, *Mr. Menzies* (BM).

Observation. — Though placement of this new species into subgenus and section is difficult, it was finally decided that it must belong in the subgenus *Telanthera* because the stamens are joined into a long, slender filament tube, bearing filiform filament tips and 5 linear anthers which are much exceeded by ligulate pseudostaminodia; and the stigma is capitate; even though the pseudostaminodia are entire.

There seem to be two choices to make in the assignment of this species to a section. The first choise is to place it in subgenus *Telanthera* and in its section *Bucholzia* as treated by Schinz (1934 : 74-75) and it fits there fairly well, except that instead of flower heads axillary and terminal, and pseudostaminodia lacerate, it has the heads terminal only and the pseudostaminodia ligulate, entire. The other choice is to make this new species the basis of a new section. It does not fit the characters of the other two sections, *Brandesia,* and *Mogiphanes.* The logical step is to describe it as new.

PACIFICA sect. nov. (subgenus *Telanthera*)

Inflorescentiis terminalibus sessilibus, loribus bisexualis, sepalis inaequalibus rigidis quam bracteas longioribus, staminibus 5, filamentis in tubo longo connatis, antheris linearibus, pseudostaminodiis ligulatis integris acutis quam staminas longioribus, stigma capitata.

Inflorescence terminal, sessile; flowers perfect; sepals unequal, rigid, longer that the floral bracts; stamens 5; filaments united into a long tube; anthers linear; pseudostaminodia ligulate, entire, acute, longer than the stamens; stigma capitate.

Typus : Alternanthera Menziesii St. John.

Discussion. — Though *A. Menziesii* represents a new section, it is still desirable to try to indicate the known species to which it is most similar and from this to deduce the closest relative and the probable migration route of the ancestral stock. In Polynesia, Micronesia, and Melanesia, there are records of the occurrence of eight species. However, one is a cultivated ornamental and the

others are certainly or presumably weedy adventives. These throw no light on the problem of origins. Australia, on the other hand, has eight or more species, including representations of both the subgenera *Alternanthera (Eualternanthera)* and *Telanthera*. These have been checked and all are very dissimilar to the new one here described.

In tropical America and eastern and western South America there is a large number of species of *Alternanthera*. After much comparison, it is proposed that the most similar known species is *A. (Brandesia) echinocephala* (HOOK. F.) CHRISTOPHERSEN of coastal Peru and of nine of the Galapagos Islands. This South American species differs in having the flower heads peduncled; the calyx scarcely exceeding the sharply keeled, ciliate bracts; sepals keeled on the back, the interior ones a little the smaller; and the lacerate pseudostaminodia equalling the stamens. This resemblance to *A. echinocephala* seems to indicate a remote relationship and an American origin of the new Hawaiian *A. Menziesii*. Besides the numerous species known on continental South America, there are fourteen species indigenous to the Galapagos Islands.

Though the method of dispersal is not known, it is worth emphasizing that in *A. Menziesii* the persistent perianth which apparently falls with the fruit has arcuate spreading stiff, acerose, curved sepals. These act like little burrs, and might well have gotten tangled in the plumage of a bird.

A. Menziesii is based on an old specimen preserved in the British Museum of Natural History, London. It was not determined by its collector, but in a later, unrecognized hand in pencil, it was marked *Illecebrum*. It was filed with the undetermined specimens of *Amaranthaceae*. Dr. Archibald Menzies was surgeon and naturalist on the voyage of H. M. S. Discovery under Capt. George Vancouver. After its discovery by Capt. James Cook in 1788-89, Vancouver's voyage was the second exploring voyage to visit the Sandwich Islands, and was notable for having introduced to the islands cattle, sheep, and goats. The ship touched in March 1792 at the Kona Coast of the island of Hawaii; at Waikiki, Oahu; at Waimea, Kauai, and at Niihau. They returned in February and March 1793 to Kawaihae and Kealakekua, Hawaii; Lahaina and Haleakala, Maui; Oahu; and Kauai. For a third time the expedition returned in January 1794 to Hilo, Hawaii, with trips to the summit of Hualalai and the slopes of Mauna Loa; to Kauai; and to Niihau. No detailed locality records were made or preserved for the col-

lections of Menzies. Since he landed on most of the large islands of the Hawaiian group and made collections from sea level to 10,000 feet altitude, there seems to be no method of deducing an exact type locality. The species has not been found subsequent to the visits of Menzies in 1792-94, and it is now believed to be extinct.

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Bibliography.

Christophersen, E., A Collection of Plants from the Galapagos Islands, *Nyt Mag. for Naturvidensk.*, **70** : 67-95, 1 pl. (1932).

Howell, J. Th., The Templeton Crocker Expedition of the California Academy of Sciences, 1932, No. 9, The *Amaranthaceae* of the Galapagos Islands. *Calif. Acad. Sci., Proc.*, IV, **21** (9) : 87-116 (1933).

Schinz, H., *Amaranthaceae*, in Engler et Prantl., Natürlich. Pflanzenfam., ed. 2, **16c** : 7-85, fig. 1-46 (1933).

Standley, P. C., *Achyranthes. North Am. Fl.* **21** (2) : 95-169 (1917).

SOME COLOMBIAN FERNS COLLECTED BY M. KØIE

BY

A. H. G. ALSTON.

A small collection made by Dr. M. Køie in Colombia contained a few new species and some which require transfers to fit in with the present writer's views on classification (1). The collection is at the Botanical Garden, Copenhagen, with duplicates of most species at the British Museum and in Bogota.

GRAMMITIDACEAE

Xiphopteris longa (C. CHR.) ALSTON comb. nov.

Polypodium longum C. CHR., Ind. Fil., p. 541 (1906).

CUNDINAMARCA : Paraiso (near Sumapaz), 1400 m., *Køie* 4597.

Xiphopteris amphidasyon (KUNZE) ALSTON comb. nov.

Polypodium amphidasyon KUNZE ex METT., *Abh. Senck. Nat. Ges.*, II, p. 49 (1856).

Polypodium radicale MORITZ ex EAT., *Mem. Amer. Acad.*, n.s., VIII, p. 198 (1860) nomen nudum; HIERON., *Engl. Bot. Jahrb.*, XXXIV, p. 511 (1904) non BAK. (1867).

(1) ALSTON, A. H. G., The subdivision of the *Polypodiaceae*, *Taxon*, V, pp. 23-25 (1956).

Cundinamarca : Sumapaz, 3800 m, *Køie* 4646.

Observation. — The name *Ctenopteris* Bl. is invalid and I cannot see any marked difference between it and *Xiphopteris* Kaulf.

POLYPODIACEAE

Microgramma ciliata (Willd.) Alston comb. nov.

Polypodium ciliatum Willd., Sp. Pl., V, p. 144 (1810).

El Valle : Anchicayá (Cali-Buenaventura), 4-500 m, *Køie* 4863.

Campyloneurum chlorolepis Alston sp. nov.; ex affinitate et habitu *C. angustifolii* sed squamis pallidis facile distinguitur. — Fig. 3.

Rhizoma breviter repens, usque ad 3 cm longum, 1.5 cm crassum (squamis inclusis), simplex, dense paleaceum, paleis persistentibus; paleae patentes, pallide stramineo-brunneis, delicatulae, angustissime clathrato-reticulatae, minute et distante serrulatae vel rariter ciliis reflexis indutae, apicibus angustatis, leviter sinuatis, basi ampliatae et auriculatae, cellulis latioribus et brevioribus. *Frondes* numerosae, circiter 50 cm longae, 5-12 mm latae; stipites straminei c. 5 cm longi, dorso leviter sulcati; lamina linearis, basin versus gradatim attenuata, valde coriacea, marginibus in sicco revolutis, integris; costae subtus griseae et elevatae, supra virides vel stramineae, minus elevatae; venulae immersae, supra invisa, subtus majus inconspicuae, areolatae; areolae costales aliis trapezoidalibus, aliis oblongis, venulam soriferam gerentes; areolae alterae irregulariter biseriatae; sori plerumque biseriati versus apicem venulae soriferae dispositi; venulae soriferi apice incrassatae. *Sporae* laeves.

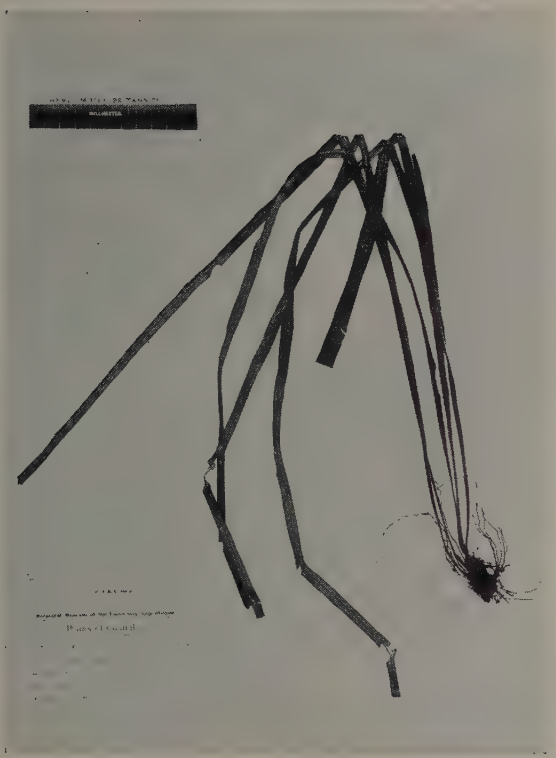
Caldes : Chinchiná (Pereira-Manizales), 1400 m, *Køie* 5208 (type).

Eschatogramme bicolor (C. Chr.) Alston comb. nov.

E. furcata var. *bicolor* C. Chr., *Dansk Bot. Ark.*, VI, p. 36 (1929).

Caldas : Chinchiná (Pereira-Manizales), 1400 m, *Køie* 5210.

Observation. — The structure of the rhizome scales separates this from *E. furcata,* and it is best regarded as a species. Christensen has given a full description.



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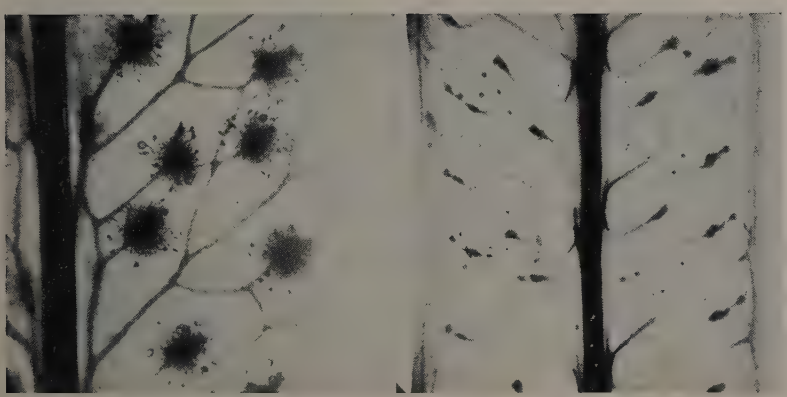

B C

Fig. 3. — *Campyloneurum chlorolepis* ALSTON : A, type specimen, Køie 5208; B, nervation of limb (× 15); C, id., (× 7).

Fig. 4. — *Blechnum gemmascens* ALSTON : type specimen, *Køie* 4584.

ASPLENIACEAE

Asplenium dimidiatum Sw. var. **lacerata** (Hieron.) Alston comb. nov.

A. praemorsum var. *lacerata* Hieron., *Engl. Bot. Jahrb.*, XXXIV, p. 469 (1904).

Tolima : near Ibagué (« Dana »), 7-800 m, *Køie* 4976.

THELYPTERIDACEAE

Cyclosorus insignis (Mett.) Alston comb. nov.

Aspidium insigne Mett., *Ann. Sci. Nat.*, sér. 5, II, p. 247 (1864).

Dryopteris insignis (Mett.) O. Kuntze, Rev. Gen. Pl., II, p. 813 (1891).

El Valle : Anchicayá (Cali-Buenaventura), 500 m, *Køie* 4747.

Goniopteris Eggersii (Hieron.) Alston comb. nov.

Nephrodium Eggersii Hieron., *Engl. Bot. Jahrb.*, XXXIV, p. 441 (1904).

Caldas : Chinchiná (Pereira-Manizales), 1400 m, *Køie* 5209.

ASPIDIACEAE

Rumohra leucostegioides (Chr.) Alston comb. nov.

Dryopteris leucostegioides C. Chr., *Vid. Selsk. Skr.*, ser. 8, VI, p. 118, fig. 28 (1920).

Cundinamarca : Ubaté, 100 km N. of Bogotá, 2600 m. *Køie* 4533.

BLECHNACEAE

Blechnum (Lomaria) gemmascens Alston sp. nov. ; ex affinitate *B. Glaziovii* (Christ) C. Chr., sed differt pinnulis sterilibus numerosis, fertilibusque acutioribus. — Fig. 4.

Caudex erectus, circa 8 cm altus. *Frondes* circa 45 cm. longi, stipitibus 20 cm, purpureis, inclusis, apicem versus gemmas perpaucas ferentibus, basi squamis pallide brunneis, membranaceis, 1 cm longis, 3 mm latis, indutis, parte pinnata ambitu oblonga, pinnis 15 utrinque latere, petiolulatis, anguste oblongis, c. 8 cm longis, 1 cm latis, minute serrato-crenatis, glabris, nervis plerumque simplicibus, apice plerumque albo-punctatis; costis squamulis paucis indutis; pinnis foliorum fertilibus angustioribus, c. 3 mm latis, subtus soris omnino tectis, costis squamulis paucis indutis, apice attenuatis. *Annulus* fere 20-cellulatus. *Sporae* fere laeves.

CUNDINAMARCA : Paraiso (near Sumapaz), 1400 m, *Køie* 4584.

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NOTES SYSTÉMATIQUES ET BIOGÉOGRAPHIQUES SUR LES *ANNONACÉES* DE MADAGASCAR ET DES COMORES

PAR

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Sans remonter aux anciennes classifications dont cette famille a fait l'objet associées aux noms d'éminents botanistes tels que Baillon (1), Bentham et Hooker (3), Engler et Diels (7), nous croyons cependant utile de dire quelques mots des travaux plus récents, publiés sur ces plantes, en vue de grouper les genres des Annonacées.

Ce sont, d'une part, l'étude d'Hutchinson (13) publiée en 1923 dans le Bulletin de Kew, et d'autre part, la révision des genres et des espèces de la Malaisie présentée par Sinclair (16) dans le Bulletin du Jardin de Singapour, paru en 1955.

1. — D'après Hutchinson, les Annonacées se subdivisent en 2 subfamilles, à savoir :

les *Annonoideae*,
les *Monodoroideae*.

La première renfermant 3 tribus, 2 subtribus et 3 séries, la deuxième ne comprenant que 2 genres indépendants.

Voici le schéma phylogénique d'Hutchinson :

Subfamille : *Annonoideae*

Tribu : *Uvarieae*
Tribu : *Miliuseae*
Tribu : *Unoneae*

Subtribu I : *Xylopineae*
Série 1 : *Hexapetalae*
Série 2 : *Tetrapetalae*
Série 3 : *Tripetalae*
Subtribu II : *Annonineae*

Subfamille : *Monodoroideae*

Hutchinson reconnaît que la subdivision en séries de la subtribu *Xylopineae* est artificielle. Ce point de vue est partagé par Sinclair qui propose pour la subtribu *Annonineae* d'Hutchinson, le rang de tribu et qui groupe les membres restants de la tribu *Unoneae* du même auteur, en 3 tribus.

2. — Voici la classification proposée par Sinclair :

Subfamille : *Annonoideae*

Tribu : *Uvarieae*
Tribu : *Miliuseae*
Tribu : *Unoneae*
Tribu : *Xylopieae*
Tribu : *Mitrephoreae*
Tribu : *Annonineae*
Subfamille : *Monodoroideae*

Si nous n'acceptons pas les « séries » d'Hutchinson, nous adoptons par contre les idées d'Hutchison quant à la division de la tribu *Unoneae* en 2 subtribus, car elle est fondée sur des caractères stables pris dans le gynécée.

En ce qui concerne les « séries » nous ne lui accordons pas une valeur absolue. En effet, il suffirait de rappeler parmi la série

Hexapetalae de Hutchinson, le genre africain *Monanthotaxis* où l'on trouve des fleurs 4-mères, les espèces asiatiques de *Desmos* à 3 pétales ou à 2 pétales et enfin le *Polyalthia heteropetala* de Madagascar à 12 pétales, pour ne citer que quelques exemples.

Les *Annonacées* de Madagascar se distribuent ainsi :

Subfamille : *Annonoideae*
Tribu 1 : *Uvarieae*
Uvaria : 14 espèces + 3 variétés

Tribu 2 : *Miliuseae*
Miliusa 1 espèce, introduite

Tribu 3 : *Unoneae*
Subtribu : *Xylopineae*
Desmos : 1 espèce, introduite
Cananga : 1 espèce, introduite
Hexalobus : 1 espèce
Xylopia : 23 espèces + 2 variétés
Artabotrys : 6 espèces + 3 var.
Polyalthia : 16 espèces
Popowia : 18 espèces + 4 var.
Subtribu : *Annonineae*
Annona : 4 espèces + 1 var., introduites
Subfamille : *Monodoroideae*
Isolona : 5 espèces + 1 var.

Au total 11 genres, 90 espèces et 14 variétés. Le nombre d'esppèces introduites est de 6.

Il n'est pas sans intérêt de noter ici les travaux des botanistes qui se sont occupés d'une façon spéciale des Annonacées de Madagascar en indiquant les genres et les espèces cités dans ces ouvrages.

La première liste d'Annonacées malgaches est due à Hoffman (12) d'après les récoltes effectuées par Hildebrandt; cette liste est datée de 1881. Hoffman mentionne les genres *Artabotrys* (2 espèces), *Polyalthia* (1 espèce), *Popowia* (2 espèces), *Annona* (1 espèce) et enfin *Bocagea* (1 espèce).

En 1882, Baillon (1) publie une « liste des plantes de Madagascar ». Il y indique 4 genres d'Annonacées qui n'avaient pas encore été signalés dans la grande île, à savoir : *Uvaria* (4 espèces), *Unona* (9 espèces, incl. sect. *Polyalthia*, sect. *Popowia*, sect.

Clathrospermum et sect. *Unonella*), *Xylopia* (incl. sect. *Pseudonona*, 5 espèces) et *Monodora* (1 espèce). En résumé, Baillon signale donc 24 espèces d'Annonacées réparties en 7 genres.

Dans son « Compendium des plantes malgaches » paru en 1900 dans la revue de Madagascar, Baron (2) mentionne 9 genres, dont 2 nouveaux pour la Grande-Ile. Il s'agit ici des genres *Polyalthia* (*P. lucens* Baker) et *Popowia* (*P. micrantha* Bak.). Le nombre d'espèces passe alors des 24 signalées par Baillon, à 27 et une variété.

Palacky (15) publie en 1907 un « Catalogue Plantarum Madagascariensium ». Il y mentionne 45 espèces partagées en 9 genres. Le genre *Hexalobus* y est cité pour la première fois et le *Polyalthia* n'y figure plus.

La première revision des Annonacées malgaches est due à Diels (7) qui dresse des clés dichotomiques des genres et des espèces et met de l'ordre à la confusion qui règnait jusqu'à cette époque quant aux noms spécifiques et leur position systématique. Diels mentionne dans son travail 8 genres, dont un nouveau *(Fenerivia)* et 51 espèces dont 30 nouvelles.

En 1939, Ghesquière (8) s'est occupé des Annonacées de l'herbier malgache et a publié une note dans laquelle il donne la synonymie d'un *Popowia* et d'un *Polyalthia* malgaches, que nous indiquerons plus loin.

Synoymie, changements, et taxa nouveaux.

L'*Uvaria catocarpa* Diels qui n'est pas une bonne espèce nouvelle doit être considéré comme une simple variété d'une espèce déjà connue du Mozambique et du Tanganyika, l'*U. acuminata* Oliv. Il se distingue de ce dernier par ses feuilles plus longues et glabrescentes, à poils épars et ferrugineux :

Uvaria acuminata Oliv. var. *catocarpa* (Diels) stat. nov.
Basinyme : *U. catocarpa* Diels.

Six *Uvaria* nouveaux ont été décrits, de même 4 *Polyalthia*.

Le *Xylopia decidua* Diels tombe en synonymie du *X. bemarivensis* Diels car les feuilles sont également caduques chez *X. bema-*

rivensis. Quant à la grandeur, la consistance et la pilosité du limbe, on trouve tous les intermédiaires dans cette espèce.

Le *X. platynema* Diels passe dans la synonymie du *X. Humblotiana* Baill. étant données la similitude des graines et la variabilité dans la longueur des pétales jeunes et adultes.

Nous décrivons 12 *Xylopia* et 2 variétés, tous nouveaux.

En ce qui concerne les *Artabotrys*, nous avons fait une combinaison nouvelle : *A. scytophyllus* (Diels) Cavaco et Keraudren. (Basinyme : *Popowia ? scytophylla* Diels, Notizbl. Bot. Gart. Berl., IX (1925), 347.)

Par ailleurs nous avons établi 2 formes dans l'*A. mabifolius* Diels, à savoir : fa. *villosus* et fa. *intermedius*, une variété nouvelle d'*A. Hildebrandtii* O. Hoffm., la var. *Bathiei*, et enfin une espèce nouvelle, *A. luxurians*.

Dans le genre *Isolona*, une espèce nouvelle et une variété ont été créées, et dans le genre *Popowia* nous décrivons 4 espèces nouvelles et 4 variétés. Les 3 genres suivants *Desmos*, *Cananga* et *Miliusa* n'avaient pas encore été signalés jusqu'à présent dans la Grande Ile.

Répartition géographique.

En relevant les indications des échantillons récoltés jusqu'à ce jour, nous avons constaté que les Annonacées ne dépassent guère l'altitude de 1400-1600 mètres. Elles abondent dans les territoires inférieurs à 800 mètres sauf quelques espèces que l'on trouve à des altitudes supérieures. Ainsi le *Xylopia Perrieri* recueilli par Perrier de la Bâthie (n° 16745) vers 1600 m d'altitude entre l'Ikopa et la Betsiboka, le *Popowia caesia* var. *elongata*, sur le mont Tsaratanana (Perrier n° 15545) à une altitude de 1500 m et beaucoup d'autres genres à des altitudes voisines sur la montagne d'Ambre.

Si les Annonacées se rencontrent dans les régions variées des domaines phytogéographiques de Madagascar, elles sont rares dans le Sud de la Grande Ile où nous n'avons noté qu'un seul échantillon, l'*Uvaria manjensis*, espèce qui appartient aussi au domaine de l'Ouest.

Le nombre particulièrement réduit d'espèces africaines et asiatiques représentées à Madagascar peut s'expliquer d'une part par les

distances énormes qui séparent la Grande-Ile des continents, et d'autre part en raison de la morphologie des fruits et des graines qui n'est pas de nature à faciliter la propagantion des Annonacées sur des aires aussi vastes. En effet, les fruits lourds, indéhiscents, dépourvus de poils crochus, d'épines, d'ailes, de flotteurs, ne sont pas munis de moyens qui permettent leur dissémination par les oiseaux migrateurs, par le vent et par les courants marins, et par l'homme involontairement au cours de ses déplacements. De même, les graines sont dépourvues d'appareils de vol et ne sont pas légères. Les courants marins, notamment celui du Mozambique, permanent le long de la côte orientale d'Afrique, entraîne les eaux du Nord au Sud dans le canal du Mozambique et peut transporter les graines qui arrivent à la mer par les cours d'eau ou les rivières.

Mais il faut encore que ces graines puissent germer après une immersion prolongée dans l'eau de mer, ce qui n'est pas prouvé.

Ces divers agents de dissémination jouent certainement un rôle dans la propagation des espèces d'Annonacées dans la Grande-Ile, mais ils ne peuvent expliquer l'aire étendue de distribution des genres que si l'on admet l'existence d'anciennes connections territorialess. Celles-ci se seraient faites soit par des ponts intercontinentaux, soit plus vraisemblablement par la continuité des continents (théorie de la dérive des continents modifiée par du Toi, Wulf et d'autres).

L'action de l'homme dans la propagation des Annonacées peut s'appliquer tout particulièrement au genre *Annona*. Il faut le signaler comme introduit sans doute à Madagascar. Ainsi l'*A. chrysophylla* et sa variété *porpetac* apparaissent partout où la forêt a été dénudée par les « tavy » ou feux de brousse, là où la flore autochtone a été détruite, et ces espèces ne font l'objet d'aucune culture. Elles sont abondantes dans le Sambirano et parfaitement naturalisées, et leur propagation s'est faite par les sangliers (zoochorie).

Quant à l'introduction d'espèces utiles par culture, il faut signaler le *Cananga odorata,* originaire de l'Asie tropicale, dont on extrait des fleurs un parfum très estimé, connu sous le nom d'ilang-ilang.

Deux autres genres asiatiques, *Desmos* et *Miliusa* ont été introduits à Madagascar puisque nous possédons quelques échantillons de *D. chinensis* et *M. indica,* mais ces deux espèces ne sont pas largement introduites, mais seulement cultivées d'une façon toute restreinte.

La distribution géographique des espèces d'*Annonacées* sera représentée par des tableaux se rapportant aux différents genres.

MADAGASCAR
CARTE DE LA VÉGÉTATION
d'après
le Professeur H.HUMBERT
Membre de l'Institut
DISTRIBUTION GEOGRAPHIQUE
DES
ANNONACÉES
Popowia
Xylopia
Artabotrys
Polyalthia
Uvaria
Isolona
Annona
Cananga
Desmos
Hexalobus
TERRITOIRES PHYTOGÉOGRAPHIQUES
I Est
II Sambirano
III Centre
IV Htes montagnes
V Ouest (inclus secteur nord)
VI Sud
limites des régions
50 0 50 100 150 200 Kms

1. Uvaria.

Domaines phytogéographiques	Est	Sambirano	Centre	Ouest	Sud
U. combretifolia Diels				+	
U. Decaryana Cav. et Ker.				+	
U. lemurica Diels				+	
U. Leandrii Ghesq. ex Cav. et Ker.				+	
U. ambongensis (Baill.) Diels				+	
U. amplexicaulis Diels				+	
U. diplocampta Diels				+	
U. Humbertii Ghesq. ex Cav. et Ker. ...				+	
U. manjensis Cav. et Ker.				+	+
U. Bathiei Ghesq. ex. Cav. et Ker.				+	
U. furfuracea (A. DC.) Baill.	+				
U. Commersoniana Baill.	+				
U. acuminata Oliv. var. catocarpa (Diels) Cav. et Ker.	+				
U. Saboureani Cav. et Ker.			+		
U. marenteria (A. DC.) Bail.	+		+	+	

Sur 15 *Uvaria,* 10 appartiennent au domaine de l'Ouest, 1 au Centre, 3 à l'Est, 1 au Sud et à l'Ouest, et enfin 1 appartient aux 3 domaines mentionnés ci-dessus, et se présente sous 3 formes différentes, à savoir :

U. marenteria fa. *marenteria* à l'Est
U. marenteria fa. *obtusiuscula* au Centre
U. marenteria fa. *acuta* à l'Ouest.

Il est curieux de constater que les *Uvaria* malgaches se répartissent en trois groupes : un à l'Ouest, un à l'Est, et une espèce qui habite le Centre. L' *U. marenteria* qui s'est différenciée en 2 formes nouvelles, l'une à feuilles aiguës qui habite les collines et plateaux calcaires du secteur Nord du domaine de l'Ouest, l'autre à feuilles subobtuses qui habite les bois secs du Centre, constitue une exception.

Il faut aussi noter l'*U. manjensis* Cavaco et Keraudren, qui du domaine de l'Ouest s'étend jusqu'à Tulear (Tongombory) dans le domaine du Sud.

Par ailleurs, une seule espèce est commune au continent africain, les autres étant particulières à la Grande-Ile. Il s'agit de l'*Uvaria acuminata* Oliv. du Tanganyika et du Mozambique. L'isolement de l'Ile au Crétacé Supérieur ou au début de l'ère Tertiaire, et

par la suite les variations du milieu, ont fait apparaître une variété nouvelle à feuilles plus longues, à poils d'une teinte différente. C'est la variété *catocarpa* qui habite le domaine de l'Est.

Les espèces d'*Uvaria* s'accumulent donc dans le domaine de l'Ouest. Si l'on croit la théorie de Willis (17), contestée notamment par Cain (4), les espèces à aires plus réduites, particulières aux domaines de l'Ouest ou de l'Est, seraient les plus jeunes.

2. Hexalobus.

La présence de ce genre est douteuse à Madagascar. Il est représenté par une seule espèce, l'*H. callicarpus*, dont on ignore les fleurs. Elle est localisée dans le domaine de l'Est.

3. Xylopia.

Domaines phytogéographiques	Est	Sambirano	Centre	Ouest	Sud
X. Capuronii Cav. et Ker.	+				
X. amplexicaulis (Lamk.) Baill.	+				
X. grandiflora (Lamk.) Gesq. ex Cav. et Ker.	+				
X. flexuosa Diels	+				
X. beananensis Cav. et Ker.	+				
X. pseudolemurica Cav. et Ker.	+				
X. microphylla Cav. et Ker.	+				
X. fananehanensis Cav. et Ker.	+				
X. Ghesquiereana Cav. et Ker.	+				
X. Dielsii Cav. et Ker.	+				
X. madagascariensis Cav. et Ker.	+				
X. Humblotinia Baill.	+				
X. Lamii Cav. et Ker	+		+		
X. Danguyella Ghesq. ex. Cav. et Ker.	+		+	+	
X. lemurica Diels	+		+		
X. buxifolia Baill.	+		+	+	
X. Lastelliana Baill.	+		+		
X. Perrieri Diels	+		+		
X. ambanjensis Cav. et Ker.		+	+	+	
X. bemarivensis Diels		+		+	
X. Humbertii Ghesq. ex Cav. et Ker.			+		
X. sericolampra Diels				+	
X. sahafariensis Cav. et Ker.				+	

Les *Xylopia* malgaches se répartissent en 4 groupes principaux :

1) Un groupe qui s'étend sur le domaine de l'Est et qui comprend plus de 50 % d'espèces particulières à ce domaine.

2) Un groupe qui habite le domaine de l'Ouest.

3) Un groupe qui s'étale de la région orientale à la région occidentale.

4) Enfin, un groupe confiné à la région malgache orientale comprenant des espèces communes aux domaines de l'Est et du Centre et une particulière au Centre.

Le domaine de l'Est est peuplé de plus de 80 % des espèces de *Xylopia* de la Grande Ile.

Mis à part le *X. amplexicaulis* et le *X. grandiflora* qui se retrouvent à la Réunion, et dont la présence à Madagascar est douteuse (un seul échantillon étiqueté « Madagascar », mélangé à d'autres provenant de Maurice, tous récoltés par Commerson), tous les *Xylopia* malgaches sont spéciaux à la Grande Ile et ne montrent pas d'affinités précises avec les espèces africaines et asiatiques. On peut supposer qu'ils ont peut-être une souche ancestrale commune avec des espèces asiatiques, vu la prédominance des *Xylopia* sur la côte orientale.

Le genre *Xylopia* a une aire de distribution très vaste, ce qui paraît être un caractère ancestral d'après Willis (17). Vers le début du Miocène eut lieu la rupture finale du continent du Gondwana, et si l'on admet la théorie de la dérive des continents, et les idées de Wulff (18), la flore de chaque fragment, après dislocation (Afrique, Madagascar, Inde et Australie), gardât d'une part, des types particuliers, d'autre part, des types communs aux autres fragments.

Les *Xylopia* de Madagascar sont-ils des types particuliers, vestiges du Continent de Gondwana ? Le manque d'affinités mentionné plus haut peut-il corroborer ce point de vue ?

A l'intérieur de l'Ile ont pu se produire des changements de climats faisant disparaître des types communs à d'autres continents et qui ne trouveraient plus les conditions de « tolérance » nécessaires à la survie (théorie de la tolérance de Good (9). D'autres types primitifs qui occupaient l'Ile ont survécu et se sont différenciés par la suite, aboutissant ainsi à la formation d'espèces nouvelles comme l'admet Guppy (11).

4. Artabotrys.

Domaines phytogéographiques	Est	Sambirano	Centre	Ouest	Sud
A. scytophyllus Diels) Cav. et Ker ...		+	+	+	
A. mabifolius Diels	+		+	+	
A. luxurians Ghesq. ex Cav. et Ker. ...	+	+			
A. unicatus (Lamk.) Merrill		+			
A. madagascariensis Miq.	+	+	+	+	
A. Hildebrantii A. Hoffm.		+			

Sur un total de 6 espèces. 5 habitent le Sambirano. Si l'on admet que le centre de dispersion d'un groupe se trouve dans la partie de son aire où il est représenté par le plus grand nombre de formes, les *Artabotrys* malgaches auraient leur centre dans le domaine du *Sambirano*. Par ailleurs, il faut remarquer que deux espèces ne se retrouvent pas dans un autre domaine à Madagascar. mais l'une, *A. uncinatus,* est signalée aux Comores et semble être originaire de l'Inde méridionale et de Ceylan. L'aire disjointe de cette espèce doit parvenir du morcellement d'une aire primitivement continue avant la cassure du continent de Gondwana.

Une seule espèce, l'*A. madagascariensis,* s'étale de l'Est à l'Ouest.

5. Polyalthia.

Domaines phytogéographiques	Est	Sambirano	Centre	Ouest	Sud
P. emarginata Diels	+				
P. madagascariensis Cav. et Ker.	+				
P. Chapelieri Baill.	+				
P. heteropetala (Diels) Gesq.	+				
P. Capuronii Cav. et Ker.	+				
P. Humblotii Drake ex Cav. et Ker. ...		Comores			
P. Henrici Diels				+	
P. Perrieri Cav. et Ker.	+				
P. decora Diels	+				
P. Richardiana Baill.		+			
P. oligosperma (Dangy) Diels	+		–		
P. Lamii Cav. et Ker.	+				
P. Humbertii Cav. et Ker.	+				
P. Leandrii Cav. et Ker.	+				
P. Ghesquiereana Cav. Cav. et Ker. ...	+				
P. Dielsii Cav. et Ker.	+	+			

Les espèces de *Polyalthia* sont en plus grand nombre dans le domaine de l'Est, et celui-ci constituerait un centre de dispersion pour les espèces malgaches.

Sur 15 espèces, 13 habitent ce domaine et parmi ces dernières, 11 espèces ne se retrouvent pas dans les autres domaines. Une espèce est particulière au domaine de l'Ouest, où elle est largement répandue, c'est le *P. Henrici* Diels. Cette espèce est la seule qui présente des affinités avec les polyalthia africains, notamment avec le *P. suaveolens* Engl. et Diels. Les feuilles et les fleurs de ces deux espèces ont un aspect semblables, elles ne diffèrent que par des détails floraux (forme des sépales, largeur des pétales).

Tous les autres *Polyalthia* malgaches ne montrent pas d'affinités avec les espèces africaines et asiatiques. L'espèce des Comores, le *P. Humblotii* Drake ex Cavaco et Keraudren, montre des affinités étroites avec le *P. sacleuxii* Ghesq. (nomen nudum), de la côte orientale africaine.

6. **Popowia.**

Domaines phytogéographiques	Est	Sambirano	Centre	Ouest	Sud
P. malacophylla Diels				+	
P. pilosa Baill.	+	+		+	
P. sororia Diels		+		+	
P. Coursii Cacavo et Keraudren			+		
P. ambrensis Cav. et Ker.			+		
P. heterantha (Baill.) Diels				+	
P. podocarpa Diels		+			
P. madagascariensis Cav. et Ker.	+				
P. Capuronii Cav. et Ker.	+				
P. Humbertii Cav. et Ker.	+				
P. brachytricha Diels	+				
P. maritima (Baill.) Cav. et Ker.	+	+			
P. Boivini Baill.		+		+	
fa. stenophylla Cav. et Ker.				+	
P. valida Diels			+	+	
P. micrantha Bak.	+			+	
P. glaucocarpa Baill.		+			
P. Gerrardii (Baill.) Ghesq. ex Cav. et Ker.	+			+	
P. caesia Diels				+	
var. elongata Ghesq. ex Cav. et Ker.	+		+		
var. subacuta Ghesq. ex Cav. et Ker.				+	
P. Greveana (Baill.) Ghesq.	+			+	

Chaque domaine compte des espèces particulières : Est, 4; Sambirano 2; Centre, 2; et Ouest, 3.

7 espèces s'étalent de la Région malgache orientale à la Région occidentale. Les deux versants de la Grande Ile se partagent en nombre égal, les espèces de Popowia, soit 10 pour chaque versant.

7. Isolona.

Domaines phytogéographiques	Est	Sambirano	Centre	Ouest	Sud
I. madagascariensis (A. DC.) Engl. et Diels	+	+		+	
I. Capuronii Cavaco et Keraudren	+				
I. Humbertiana Ghesq. ex Cav. et Ker. ...				+	
I. Ghesquierei Cavaco et Keraudren ...		+			
var. longipedicellata Cav. et Ker.	+				
I. Perrieri Diels	+	+		+	

Sur les 5 espèces d'*Isolona* récoltées à Madagascar, 2 seulement sont communes aux trois domaines principaux des Annonacées malgaches : Est, Sambirano, Ouest. Les 3 autres sont particulières à l'un ou à l'autre de ces trois domaines, elles sont inconnues dans les domaines du Centre et du Sud.

8. Genres asiatiques introduits, non naturalisés.

Miliusa.

Les échantillons ne portent pas l'indication du lieu de récolte et ce genre n'est représenté que par une seule espèce, introduite, le *M. indica.*

Desmos.

Une espèce, le *D. chinensis,* introduite; elle a été récoltée aux environs de Majunga (Ouest) et de Tamatave.

Cananga.

Une espèce introduite, le *C. odorata*, récolté aux environs de Tamatave. Le Cananga existe également à l'Ile de la Réunion.

9. Genre introduit et naturalisé.

Annona.

Les *Annona* malgaches sont tous introduits. Quelques-uns cependant sont subspontanés, ainsi l'*A. chrysophylla* Boj. et sa var. *porpetac.*

Annona.

Domaines phytogéographiques	Est	Sambirano	Centre	Ouest	Sud	Comores
A. chrysophylla Boj.	+	+		+		+
var. porpetac (Baill.) ex Robyns et Ghesq	+	+				
A. glauca Thonn. var. minor Robyns et Ghesq.						+
A. reticulata L.	+	+				
A. squamosa L.				+		+

10. Espèces endémiques.

Le nombre particulièrement élevé d'espèces spéciales à la Grande Ile et le manque d'affinités précises avec les espèces asiatiques et africaines, semble indiquer que les Annonacées malgaches proviennent d'une souche primitive très ancienne.

Vers le début du Miocène, Madagascar paraît s'être séparée définitivement du continent africain, l'Inde se serait déplacée vers le Nord-Est, et la Grande-Ile s'en est isolée. Les Annonacées ainsi isolées ont dû subir alors une évolution secondaire qui a donné naissances aux espèces spéciales à Madagascar. Le nombre d'espèces malgaches est extrêmement élevé par rapport à la superficie de l'île, si l'on tient compte de l'aire occupée par les genres à la surface des terres tropicales et le nombre total de leurs espèces. En

effet, des genres largement répandus dans les régions tropicales tels que *Xylopia* (Asie, Afrique et Amérique, 100 espèces), *Polyalthia* (Asie et Afrique, 100 espèces), *Popowia* (Asie, Afrique Océanie, plus ou moins 90 espèces), sont représentés dans l'île par les chiffres suivants :

Polyalthia : 16 sp.
Xylopia : 23 sp. + 2 var.
Popowia : 18 sp. + 4 var.

Ceci peut laisser supposer qu'à Madagascar se trouvaient à l'époque où les continents communiquaient, des centres de formation d'espèces. Ce qui nous amène à penser que l'endémique est ancien, et que les espèces sont *épibiotiques* et non *néo-endémiques*. Rappelons que selon Croizat (5) l'origine des flores se situe dans l'hémisphère austral.

Le nombre d'espèces endémiques est de 79, sur un total de 90 espèces, dont 5 introduites et non naturalisées, et 14 variétés d'Annonacées malgaches.

Enfin il n'est pas sans intérêt de citer deux Annonacées qui semblent être des *espèces vicariantes*. Ce sont d'une part, le *Polyalthia Humblotii* Drake ex Cav. et Ker. très voisin du *Polyalthia Sacleuxii* de la côte orientale africaine, et d'autre part l'*Uvaria acuminata* Oliv. var. *catocarpa* (Diels) Cavaco et Keraudren (= *U. catocarpa* Diels) qui semble être vicariant de l'*U. acuminata* var. *acuminata* du Mozambique et du Tanganyika.

Liste des espèces et variétés nouvelles d'Annonacées.

1. Artabotrys.

Au cours de la revision des Annonacées pour la flore de Madagascar et des Comores qui se publie sous la direction du Professeur H. Humbert, nous avons trouvé un échantillon d'*Artabotrys* récolté par M. Decary (Decary 16336), dans le massif de l'Isalo (domaine du Centre, pentes occidentales). Les feuilles et les fruits de cet échantillon étant identiques à ceux de *Popowia Scytophylla* Diels dont on ne connaissait que de très jeunes boutons, aussi rangeons-nous l'espèce de Diels dans le genre *Artabotrys* en faisant une combinaison nouvelle.

Par ailleurs, Ghesquière, en étudiant les Annonacées de l'herbier malgache, l'avait placé dans le genre *Polyalthia* faute de crochets bien apparents, et pour la même raison, nous l'avions mis dans le genre *Xylopia*. La comparaison avec l'échantillon de Decary mentionné ci-dessus, qui est très complet, ne laisse aucun doute sur l'identité de ces espèces.

Nous remercions M. le Directeur de l'Herbier de Kew, de nous avoir communiqué les *Artabotrys* de l'Afrique orientale et australe représentés dans son établissement.

Artabotrys scytophyllus (Diels) Cavaco et Keraudren, comb. nov. — Pl. II, 3 et 4.

Popowia? scytophylla Diels, Notizbl. Bot. Gart. Berl. IX (1925), 347.

Polyalthia scytophylla (Diels) Ghesq., msc. in herb.

Xylopia Decaryana Cavaco et Keraudren, Bull. Soc. Bot. Fr. CIII (1956), 275.

Centre (pentes occidentales) : massif de l'Isalo, *Decary* 16289, 16336, 16393; *Service forestier* 12360, 14309; *Humbert* 2874, 4977, 28641 ; *Capuron* 11676 ; bassin de la Malio (affluent du Mangoky), près d'Ambalabe, *Humbert* 19422.

Ouest : Mont Vatoka (Onilahy), *Perrier* 4972 (holotype P).

Sans indication du lieu de récolte, *Baron* 57.

Habitat : Sur les sables et les grès siliceux, restes de forêt tropophile et bush xérophylle.

Artabotrys luxurians Ghesq. msc. in herb, nomen nudum, ex Cavaco et Keraudren.

Frutex magnus scandens; ramuli glabri. *Foliorum* petiolus 5 mm longus; lamina ovata vel oblonga basi late obtusa vel subrotundata, apice breviter acuminata, 6-16 cm longa, 3-6,5 cm lata; coriacea, glabra, nervis lateralibus 6-10-paribus prominulis. *Flores* solitarii vel rarius bini, pedicellis parce pilosulis, 15 mm longis; sepala triangularia, acuta, 7 mm longa et lata; petala pilosa, exteriora ovato-lanceolata, apice subacuta, 2-3 cm longa, 1-1,8 cm lata, interiora ovata, 2-2,8 cm longa, 10-12 mm lata; stamina numerosa, 2 mm

longa; carpella 9-12; ovarium glabrum, 1 mm longum; stylus circ. 3 mm longus. *Fructus* ignotus.

Est : Bas-Mutilana, vers 100 m d'alt., *Perrier* 500.

Sambirano : forêt de Lokobe, *Perrier* 18715 (holotype P).

Observation. — Cette espèce est affine de l'*A. uncinatus* (Lamk.) Merrill, mais en diffère surtout par ses feuilles subarrondies à la base et non cunéiformes.

Artabotrys Hildebrantii U. Hoffm. var. **Bathiei** Cavaco et Keraudren, var. nov. a var. *Hildebrandtii* foliis majoribus et floribus majoribus pedicellis longioribus differt.

Sambirano : mont Tsitondraina, sur les flancs droits de la vallée du Sambirano, *Perrier* 4967 (holotype P).

2. **Polyalthia.**

Le genre *Polyalthia* était représenté jusqu'à présent dans la Grande-Ile par 9 espèces. Nous donnons ci-dessous la description de 9 espèces toutes nouvelles. Ces espèces sont endémiques et ne présentent pas d'affinités précises avec les *Polyalthia* africains.

Polyalthia Capuronii Cavaco et Keraudren, sp. nov. — Pl. I, 3.

Arbor 12-15 m alta; rami glabri. *Foliorum* petiolus 5 mm longus; lamina coriacea tota glabra, forma varia elliptico-oblonga, lanceolato-oblonga vel ovata, apice obtuse acuminata basi attenuata, nervi subtus prominuli, 9-11 cm longa, 3-3,5 cm lata. *Flores* axillares solitarii; pedunculus decurvatus, 1,5 cm longus, glaber; sepala 3, ovata, 8 mm longa, 5 mm lata; petala lineari-elongata, 6 mm longa infra 4 mm lata sparse pilosa ; stamina ∞; carpella 1 mm longa, pilosa; styli brevi.

Est : J. B. 21, Tampolo-Fénérive, *Service Forestier* 9596; au Nord de Mahatalaky (Fort-Dauphin), forêt de Bemangidy, *Capuron* 11795 (holotype P); Mahatalaky (Fort-Dauphin), *Service Forestier* 12071.

Polyalthia Perrieri Cavaco et Keraudren, sp. nov.

Arbor (?); rami glabri. *Foliorum* petiolus 2 mm longus; lamina chartacea, oblanceolata vel obovata, apice obtusa, basi attenuata,

nervi paulum prominuli utrinque glabra, 7 cm longa, 2,5 cm lata. *Flores* axillares solitarii; pedunculus 6 mm longus; sepala 3 triangularia 3 mm longa, 3,5 mm lata; petala lineari-oblonga, 1,5 cm longa, 3 mm lata, sparse pilosa; stamina ∞; carpella 2 20; ovaria 1 mm longa; stigma pilosum.

Est : Vohémar, *Service Forestier* 13087 (holotype P).

Polyalthia Lamii Cavaco et Keraudren, sp. nov. — Pl. I, 6.

Arbor 10 m alta; rami glabri. *Foliorum* petiolus 5 mm longus, lamina spatulata, glabra, 5-6,5 cm longa, 1,7-2,7 cm lata, apice obtusa vel emarginata, basi attenuata, sub-coriacea; nervi paulum prominuli. *Flores* axillares solitarii; pedunculus 8-9 mm longus; sepala 7 mm longa, 4 mm lata; petala tota oblonga 12-14 mm longa 3 mm lata; stamina ∞; carpella 6; ovaria 1 mm longa; stigma pilosum.

Est : Tamatave, Tampina, Réserve Forestière, *Lam* et *Meuse* 6047 (holotype P); Ambila, *Ursch* s.n.; environs de Maroansetra, *Service Forestier* 10736.

Polyalthia Humbertii Cavaco et Keraudren, sp. nov. — Pl. I, 1.

Arbor; rami glabri. *Foliorum* petiolus 4-5 mm longus; lamina coriacea, obovata, glabra, nervi paulum prominuli, 4,5 cm longa, 3 cm lata. *Flores* solitarii axillares; pedunculus decurvatus 15 mm longus; sepala 3 triangularia 6 mm longa infra 4 mm lata; petala oblonga 2,5 cm longa 4 mm lata, glabra; stamina ∞; carpella 14; ovaria oblonga 1 mm longa sparse pilosa, stigma pilosum.

Est : environs du col d'Atondrahama, entre les bassins de la Mahalevona et de la Sahafihitra, au N. de la presqu'île Masoala, *Capuron* 8792 (holotype P).

Polyalthia Leandrii Cavaco et Keraudren, sp. nov. — Pl. I, 5.

Arbor; rami glabri. *Foliorum* petiolus 5 mm longus; lamina chartacea, glabra, ovata vel elliptica breviter acuminata basi attenuata, nervi paulum prominuli, 5,5-7 cm longa, 2,4-2,8 cm lata. *Flores* axillares; pedunculus decurvatus 15-20 mm longus; sepala 3 elliptica 7 mm longa 3,5 mm lata; petala lineari-elongata 18 mm longa, 2 mm lata; stamina ∞; carpella 18; ovaria 1 mm longa, sparse pilosa; stigma pilosulum.

Est : bassin de la Manonga, affluent r.g. de la Rantabe, vers 650 m d'alt., *Capuron* 9108.

Centre : Angodongodona, Ivohibe, *Service Forestier* 5148 (holotype P).

Polyalthia Ghesquiereana Cavaco et Keraudren, sp. nov. — Pl. I, 2.

Arbor; rami glabri. *Foliorum* petiolus 2-4 mm longus ; lamina chartacea, oblongo-elongata, glabra, 8-9 cm longa, 4 cm lata, apice acuminata. *Flores* solitarii axillares ; pedunculus 10 mm longus ; sepala 3 oblonga 6 mm longa 4 mm lata; petala lineari-lanceolata 3 cm longa 2 mm lata; stamina ∞; carpella 34; ovaria 1 mm longa sparse pilosa; stigma pilosulum.

Est : massif du Betsomanga, bassin de l'Androranga (Bemarivo du Nord-Est) au Nord du massif du Marojejy, vallon du flanc Sud, *Capuron* 848; vallée inférieure de l'Androranga, affluent de la Bemarivo (Nord-Est), aux environs d'Antongondriha, massif du Betsomanga, *Humbert* 24243 ; environs de Maroantsetra, *Service forestier* 12910; forêt de Tampolo, au Nord de Fénérive, *Capuron* 8619, *Service forestier* 15214, 15326, *Réserves naturelles* 7684; environs de Tamatave, *Réserves naturelles,* RNI, 2608, 2860, 3241, 3254; Ambila, Brickaville, *Service forestier* 1108.

Polyalthia Dielsii Cavaco et Keraudren, sp. nov. — Pl. I, 4.

Arbor 20-25 m alta; rami glabri. *Foliorum* petiolus 5-8 mm longus; lamina chartacea, oblongo-elliptica, glabra, 6,5-8 cm longa, 3-4,5 lata, apice acuminata basi attenuata. *Florum* pedunculus 10-12 mm longus; sepala 6 mm longa, 4 mm lata, oblonga; petala lanceolata 14 mm longa, 4 mm lata ; stamina ∞; carpella c. 30 ; ovaria 1 mm longa sparse pilosa; stigma pilosulum.

Sambirano : Nossi-Bé, *Réserves Naturelles* 2725 (holotype P).

Est : forêt d'Analamazaotra, *Perrier* 4935.

Polyalthia Humblotii Drake nomen nudum msc. in herb., ex Cavaco et Keraudren.

Arbor 20 m alta; rami glabri. *Foliorum* petiolus 3-4 mm longus; lamina chartacea, glabra, elliptica vel oblongo-elliptica apice atte-

nuata vel acuminata basi obtusa vel attenuata, nervi pauloum prominuli, 7-15,5 cm longa, 2,8-6,5 cm lata. *Flores* solitarii axillares; pedunculus 20-26 mm longus; sepala triangularia, 8-12 mm longa, 3-5 mm lata, pilosa; petala obovato-oblonga, 3-4,5 cm longa, 8-17 mm lata; stamina numerosa; carpella 40; ovaria 1 mm longa, pilosa; stigma oblonga. *Fructus* pedunculo 2,5 cm longo; carpella matura stipitata stipite 10-15 mm longo, ovoidea, breviter apiculata, 8-10 mm longa, 7 mm lata.

Comores : Anjouan, *Humblot* 1578 (holotype P); *Lavanchie*, sans numéro.

Polyalthia madagascariensis Cavaco et Keraudren, sp. nov.

Arbor (?); ramuli cinereo-corticati, glabri. *Folia* lanceolata, apice basique obtusa, 2,5-4,5 cm longa, 1-1,5 cm lata, glabra, integra; nervi laterales inconspicui; petioli circiter 3 mm longi, supra sulcati. *Flores* axillares, solitarii; pedunculus 7-8 mm longus, glaber; bracteae spatulatae, 0,5-1 mm longae, intus pilosae; sepala ovato-lanceolata, 3 mm longa, 2 mm lata, apice pilosa; petala ovato-lanceolata, 4-5 mm longa, 2 mm lata, glabra; stamina ± 40; carpella 5; ovaria 0,8 mm longa, glabra; stigma papilosa.

Est : Fort-Dauphin, Mandena, J.B. 14, *Service Forestier* 14599 (holotype P).

3. **Isolona.**

Le genre *Isolona* renferme près de 20 espèces dont 5 malgaches, l'*I. madagascariensis*, l'*I. Perrieri*, l'*I. Ghesquierei* sp. nov., l'*I. Humbertiana*, sp. nov. et l'*I. Capuronii* sp. nov. Nous donnons ci-dessous, la diagnose latine de ces nouvelles espèces.

Isolona Ghesquierei Cavaco et Keraudren, sp. nov. — Pl. II, 5.

Arbor (?); cortice fuscato ruguloso. *Foliorum* petiolus 5 mm longus; lamina chartacea, glabra, elliptico-oblonga, apice acuminata, basi obtusa, summo apice obtusiusculo, 10-14,5 cm longa, 4-5,2 cm lata, integerrima; costa venisque utrinque (in sicco) prominulis. *Flores* axillares solitarii; pedunculus 6 mm longus; calyx brevis 3-fidus, lobis obtusis glabris; corolla campanulata glaberrima; petala oblonga, 2,5 cm longa, 5 mm lata; stamina ∞; ovarium

Polyalthia Humbertii : 1, rameau florifère (× 2/3). — *P. Ghesquiereana :* 2, fleur (× 2/3). — *P. Capuronii :* 3, fleur (× 2/3). — *P. Dielsii :* 4, rameau florifère (× 2/3). — *P. Leandrii :* 5, fruit (× 2/3). — *P. Lamii :* 6, feuille et fleur (× 2/3). — *Uvaria manjensis :* 7, feuille et bouton (× 2/3). — *U. Bathiei :* 8, fruit (× 2/3). — *U. Leandrii :* 9, fruit (× 2/3). — *U. Saboureaui :* 10, fruit (× 2/3). — *U. Humbertii :* 11, rameau florifère (× 2/3); 12, fleur, les pétales enlevés (× 2). — *U. Decaryana :* 13, coupe longitudinale d'une fleur (× 2).

conicum, glabrum; stylo crasse capitato peltato, basi annulo prominulo orbiculari cincto. *Fructus* ignotus.

Sambirano : Maromandia, Antalaha, forêt Andongozabe, *Service Forestier* 12451 (holotype P).

Observation. — Ce nouveau taxon est affine de l'*I. Perrieri* Diels dont il se distingue surtout par ses pétales foliacés, oblongs, par son pédicelle et son calice pubescents.

Var. **longipedicellata** Cavaco et Keraudren, var. nov., a var. *Ghesquierei* differt floribus majoribus, pedicellis longioribus.

Est : Réserve naturelle n° 1, Betampona, vers 450 m d'alt., *Capuron* 8587 (holotype P).

Isolana Humbertiana Ghesquière msc. in herb., nomen nudum, ex Cavaco et Keraudren.

Frutex 3-4 m altus. *Foliorum* petiolus 4 mm longus; lamina subcoriacea, glabra, oblongo-lanceolata, apice obtusa, basi subrotundata, 8-16 cm longa, 3,1-5,6 cm lata. *Flores* axillares solitarii vel bini; pedunculus 5-7 mm longus; sepala late ovata 3 mm longa 3-4 mm lata; petalorum tubus 5 mm longus; petala oblongo-lanceolata 1,5 cm longa, 3-4 mm lata; ovarium glabrum; stigma amplum.

Ouest : Ankaladina, sur la Betsiboka (Boïna), *Perrier* 1511 (holotype P).

Observation. — Cette espèce est affine de l'*I. madagascariensis*. En diffère surtout par ses feuilles subarrondies à la base et non acuminées au sommet. Les feuilles de l'*I. Humbertiana* ressemblent à celles de l'*I. Heinsenii* Engl. et Diels, de l'Afrique orientale.

Isolona Capuronii Cavaco et Keraudren, sp. nov.

Arbor. Folia persistentia; petiolus 3-5 mm longus; lamina subcoriacea, glabra, oblongo-elliptica, apice acuminata, basi obtusa, 8-15 cm longa, 2,7-4,7 cm lata; nervi laterales primarii 8-10. *Flores* axillares vel extraaxilares, bini vel rarius solitarii; pedunculus 1-1,5 cm longus; sepala ovata, acuminata, 4-5 mm longa 2 mm lata; petalorum tubus 4 mm longus; petala oblongo-lanceolata 15-17 mm longa, 4 mm lata, coriacea, glabra; ovarium glabrum; stigma amplum bilobatum.

Est : restes de forêts à Ambodiatafana, au N. du village de Mahasoa, embouchure de la Rantabe, vers 50 m d'alt., *Capuron* 8941 (holotype P).

Observation. — Cette espèce est voisine de l'*I. madagascariensis* dont elle se distingue surtout par ses fleurs géminées à sépales acuminés réfléchis.

4. Popowia.

Le genre paléotropical *Popowia* comprend 60 espèces environ, dont 14 dans la Grande-Ile. Nous décrivons ci-dessous 4 espèces nouvelles de Madagascar.

Popowia Capuronii Cavaco et Keraudren, sp. nov. — Pl. II, 7.

Arbor magna; ramuli glabri. *Folia* persistentia; petiolus 7 mm longus; lamina coriacea, in utraque facie glabra, obovata, basin versus ± angustata, apice rotundata vel emarginata, 7-10 cm longa, 3,5-5 cm lata; nervi laterales primarii circ. 8. *Flores* fasciculati, bini vel terni; pediceli adpresse pubescentes, 12 mm longi; sepala minuta ovata-triangularia, 2 mm longa, 3 mm lata; petala carnosula pilosa : 3 exteriora concava apice cuculata, 8-9 mm longa, 6 mm lata; 3 interiora, excavata, 6 mm longa, 3 mm lata; stamina 13,3 mm longa; carpella 5, 3 mm longa, 1 mm lata.

Est : aux environs du col d'Antondradama (piste Maroantsetra-Antalaha, vers 500 m d'alt., *Capuron* 8751 SF. (holotype P); environs de Farafangana, *Service forestier* 15.301.

Nom vernaculaire : Robavy.

Observation. — Espèce voisine du *P. obovata* (Benth.) Engl. de l'Afrique, dont elle se distingue facilement par ses feuilles cunéiformes à la base et non arrondies ni cordées, et par d'autres caractères. Du *P. diospyrifolia* Pierre ex Finet et Gagnepain de l'Asie et du *P. dicranantha* de l'Afrique orientale dont elle est proche se distingue aisément par ses pédoncules floraux très épais et robustes.

Popowia Coursii Cavaco et Keraudren, sp. nov. — Pl. II, 8.

Frutex scandens fere 10 m longus; ramuli glabri. *Foliorum* petiolus 3 mm longus; lamina subcoriacea, in utraque facie glabra, ovata,

apice attenuata acuminata vel rotundata, basi truncata, 2,5-6 cm longa, 2-3,8 cm lata; nervi laterales primarii supra tenues subtus paulum prominuli circ. 8. *Flores* axillares solitarii; pedicelli circ. 7 mm longi; sepala triangularia, 3 mm longa, 4 mm lata, glabra; petala coriacea velutina late ovata, 3 exteriora 8 mm longa et lata, 3 interiora 5 mm longa, 4 mm lata; stamina numerosa, 1,5 mm longa, connectivo supra thecas disciformi-incrassato; carpella circ. 20, 1-2 mm longa. *Fructus* ignotus.

Centre : Amboditafonana à Ankosy, alt. 1200 m, *Cours* 2840 (holotype P).

Observation. — Sans affinités précises.

Popowia Humbertii Cavaco et Keraudren, sp. nov. — Pl. II, 6.

Frutex magnus scandens; ramuli novelli glaberscentes. *Foliorum* petiolus 5-7 mm longus; lamina chartacea, supra glabra, subtus minute pilosula, ovata vel ovato-oblonga, basi rotundata vel late obtusa, apice attenuata vel rotundata, 4-9,5 cm longa, 2,8-5,8 cm lata; nervi laterales primarii tenues. *Flores* axillares solitarii vel bini; pedicelli adpresse pubescentes, circ. 6 mm longi; calyx breviter 3-lobatus, lobis late triangularis minute pilosis, 2 mm longis, 3 mm latis; petala coriacea pilosa, exteriora lata ovata apice breviter acuminata, 9 mm longa, 8 mm lata, interiora 5,5 mm longa, 3 mm lata; stamina numerosa; carpella circ. 15, uniovulata; ovarium glabrum, circit. 1,2 mm longum; stylus circ. 0,5 mm longus. *Fructus* ignotus.

Ouest : vallée de l'Andalangy, affluent de l'Androranga (bassin de la Bemarivo du Nord-Est), *Humbert* 24.174 (holotype P).

Observation. — Espèce affine du *P. macrocarpa* (Baill.) Ghesq., mais en diffère par ses fleurs fasciculées à pédicelle fort densément vellu.

Popowia madagascariensis Cavaco et Keraudren, sp. nov. — Pl. II, 9 et 10.

Frutex scandens; ramuli novelli glabrescentes. *Foliorum* petiolus 9 mm longus; lamina obovato-oblonga, acuminata apice ipso obtusa, papyracea, 7-12,5 cm longa, 3,5-4,7 cm lata, glabra, subtus sub lente pilis minutis in costa nervisque primariis conspersa; nervi laterales primarii supra tenues subtus paulum prominuli circ. 8-12.

Flores fasciculati; pedicelli 1-1,5 cm longi adpresse pubescentes; calyx cupularis breviter 3-lobatus; lobis minute pilosis, 2 mm longis, 3 mm latis; petala carnosula, pilosa, ovata, exteriora 5 mm longa et lata, breviter acuminata, interiora apice attenuata, 5 mm longa, 2,5 mm lata; stamina circit. 25; carpella circit. 20, unioculata; ovarium pilosum, 1 mm longum; stylus circ. 0,3 mm longus, pilosus, apice papillosus.

Est : Antalaha, *Réserves Naturelles* 7092 (holotype P).

Nom vernaculaire : Rangomanitra.

Observation. — Espèce voisine du *P. pachypetala* Diels d'Australie et du *P. Le Testui* Pellegrin d'Afrique par ses inflorescences fasciculées mais en diffère par la taille de ses fleurs, la dimension de ses pédicelles et enfin par la forme de ses pétales et carpelles. Elle se rapproche du *P. pisocarpa* (Bl.) Engl. d'Australie et du *P. Helferi* Hook. f. d'Asie par ses feuilles longuement acuminées, mais en diffère par ses inflorescences fasciculées.

5. **Uvaria.**

Le genre *Uvaria* groupe plus de 100 espèces de l'Asie tropicale, de l'Afrique et de l'Océanie. A. Madagascar vivent 15 espèces, dont 6 constituent des nouveautées pour la Flore de la Grande-Ile et sont décrites ci-dessous :

Uvaria Saboureaui Cavaco et Keraudren, sp. nov. — Pl. I, 10.

Frutex volubilis; ramuli ferrugineo-pubescentes. *Foliorum* petiolus, 1,5 cm longus, pilosus; lamina coriacea, supra glabra, subtus dense ferrugineo-stellato-pilosa, forma varia, obovata vel oblonga-elliptica, apice late obtusa vel acute acuminata, basi cuneata, 6-9 cm longa, 3,5-4,3 cm lata; nervi laterales 7-10. *Inflorescentiae* in cymis dispositae; pedunculus circ. 8 mm longus; sepala triangularia-ovata, 3 mm longa, 4 mm lata, petala exteriora obovata, 5 mm longa, 5 mm lata, tomentosa; interiora concava, apice rotundata, 4 mm longa, 3,5 mm lata; stamina numerosa, 1-2 mm longa; carpella dense pilosa; ovaria oblonga, 1,2 mm longa; styli brevi; stigmate papillosus.

Centre : Moramanga, Périnet, *Réserves Naturelles* 1303 RN. (holotype P).

Observation. — Sans affinités précises. Les feuilles ressemblent à celles de *U. divaricata* Diels du Tanganika.

Uvaria Leandrii Ghesq. nomen nudum msc. in herb., ex Cavaco et Keraudren. — Pl. I, 9.

Arbor; ramuli pubescens. *Foliorum* petiolus 2-3 mm longus, pilosullus; lamina elliptica, apice basique attenuata, 9-10,5 cm longa, 3 cm lata, glabra, chartacea. *Flores* adhuc ignoti. *Fructus* pedunculo 2 cm longo; carpella matura stipitata, stipite 1,8 cm longo, cylindrica, stellato-pillosa, 2,7-3,2 cm longa, 1 cm lata. *Semina* 8-12, 1 cm longa, 7 mm lata.

Ouest : tsingy du Bemaraha (9e Réserve), *Leandri* 859 (holotype P).

Observation. — L'*U. Leandri* est proche de l'*U. ambogoensis* (Baill.) Diels, mais en diffère surtout par ses jeunes rameaux glabres, blanchâtres, et par ses feuilles glabres à la face inférieure.

Uvaria Humbertii Ghesq. nomen nudum msc. in herb., ex Cavaco et Keraudren. — Pl. I,, 11 et 12.

Frutex; rami novelli pilosi. *Foliorum* petiolus 2 mm longus, dense pilosus; lamina subcoriacea, supra glabra, subtus pilis dispersis praedita, ovato-lanceolata, apice acuminata, basi rotundata, 5-6,5 cm longa, 2,7-3,4 cm lata; nervi laterales tenues. *Flores* axillares, solitarii, brevissime pedunculati; pedunculus 1 mm longus, tomentellus; sepala crassa late obovata, extus tomentella, intus glabra, circ. 5 mm longa et lata; petala lanceolata, apice obtusa, extus pilosa, intus glabra, 11 mm longa, 6 mm lata; stamina numerosa, 1 mm longa; carpella numerosa, dense pilosa, 1 mm longa.

Ouest : à l'Est d'Ambondrofe, Ankarana du Nord, sur calcaires oolithiques (prov. Diego-Suarez), *Humbert* 18964 (holotype P).

Observation. — L'*U. Humbertii* est voisin de l'*U. Commersoniana* mais il s'en distingue facilement par ses feuilles obtuses à la bases, ses sépales membraneux, etc.

Uvaria Bathiei Ghesq. nomen nudum msc. in herb., ex Cavaco et Keraudren. — Pl. I, 8.

Frutex volubilis; rami novelli pilosi. *Foliorum* petiolus 4 mm longus, pilosus; lamina chartacea, supra glabra, subtus pilis dis-

Xylopia Humbertii : 1, rameau florifère (× 2/3); 2, calice et carpelles (× 2). — *Artabotrys scytophyllus :* 3, rameau florifère (× 2/3); 4, fleur (× 4). — *Isolona Ghesquierei :* 5, fleur (× 1). — *Popowia Humbertii :* 6, fleur (× 2). — *P. Capuronii :* 7, rameau florifère (× 2/3). — *P. Coursii :* 8, feuilles et bouton floral (× 2/3). — *P. madagascariensis :* 9, rameau florifère (× 2/3); 10, étamine, profil (× 12).

persis praedita. *Flores* adhuc ignoti. *Fructus* pedunculo 10-12 mm longo, piloso; carpella matura stipitata, stipite 3 mm longo, ovoidea, apice breviter rostrata, 15 mm longa, 6 mm lata, dense pilosa. *Semina* 6, triangularia, 1 cm longa, 5 mm lata, fusca.

Ouest : environs de Majunga, *Perrier* 4958 (holotype P).

Observation. — L'*U. Bathiei* est proche de l'*U. marenteria* dont il se distingue aisément par ses feuilles densément tomenteuses à la face inférieure. Les feuilles de l'*U. marenteria* sont entièrement glabres.

Uvaria Decaryana Cavaco et Keraudren, sp. nov. — Pl. I, 13.

Frutex (?). *Foliorum* petiolus 1 cm longus; lamina coriacea, glabra, elliptica vel oblongo-lanceolata, basi attenuata, apice obtusa, 9-13 cm longa, 2,7-5 cm lata; nervi laterales 9-10. *Flores* solitarii; pedunculus 3 cm longus; sepala triangularia-ovata, 3 mm longa, 4 mm lata; petala exteriora ovata, 12 mm longa, 10 mm lata, glabra, interiora concava, ovato-lanceolata, glabra, 14 mm longa, 8 mm lata; stamina numerosa, 3 mm longa; carpella 15; ovaria glabra, cylindrica, 3 mm longa; styli brevi; stigmate papillosus.

Ouest : Basse Sofia, *Decary* 14881bis (holotype P).

Observation. — Bien distincte par ses feuilles longuement atténuées à la base, par ses pédicelles floraux très longs, etc.

Uvaria manjensis Cavaco et Keraudren, sp. nov. — Pl. I, 7.

Arbor parva; ramuli cinereo-corticati. *Foliorum* petiolus 5 mm longus; lamina chartacea, glabra, oblongo-elliptica vel oblongo-oblanceolata, apice basique obtusa, 11,5 cm longa, 3,2 cm lata; nervi supra tenuiter prominuli, subtus obscuri. *Flores* juniores solum observati, solitarii; pedunculus circ. 3 mm longus; sepala triangularia, 6 mm longa, infra 4 mm lata, pilosa; petala 3 exteriora; interiora 3, triangularia-ovata, pilosulla, 5 mm longa, 3,5 mm lata; stamina numerosa, 1 mm longa; carpella 6, glabra, 1,5 mm longa; styli 0; stigmate papilosus.

Ouest : Manja, forêt Ankotrofotsy, *Service Forestier* 5309 (holotype P).

Observation. — Espèce proche de l'*U. amplexicaulis*, à feuilles semblables à celles de l'*U. Leandrii* mais à pétioles plus robustes et longs.

6. **Xylopia.**

Le genre *Xylopia* comprend plus de 100 espèces dans les régions tropicales dont 23 à Madagascar.

Nous allons décrire le *Xylopia Humbertii* sp. nov., nommé ainsi par Ghesquière sur une étiquette d'herbier et une nouvelle espèce.

Xylopia Humbertii GHESQ. nom. nud. msc. in herb., ex CAVACO et KERAUDREN. — Pl. II, 1 et 2.

Arbor parva; rami cinereo-corticati; ramuli novelli cortice rubro-fusco. *Foliorum* petiolus 5 mm longus, glaber; lamina coriacea supra glabra, subtus parce pilosulla, elliptica, 5-6 cm longa, 2,2-2,5 cm lata, basi attenuata, apice breviter acuminata-obtusa. *Flores* axillares, solitarii ; pedunculus 5 mm longus, pilosus ; sepala triangularia-ovata, extus pubescentia, 3,5 mm longa, 4 mm lata; petala exteriora crassa, triangularia-lanceolata, 12 mm longa, 5 mm lata extus pubescentia, intus glabra; petala interiora basi excavata, tomentella, 12 mm longa, 3 mm lata; stamina numerosa 2 mm longa; carpella 7; ovaria tomentosa, 1 mm longa; stylus 4 mm longus; stigmate papillosus.

CENTRE : entre Mandritsara et Andilamena, alt. 900-1200 m, *Humbert* 17980 (holotype P).

Habitat : Restes de forêts et savoka du versant oriental, sur latérite de gneiss.

Xylopia Ghesquiereana CAVACO et KERAUDREN sp. nov.

Arbor ; ramuli novelli dense ferrugineo-tomentosi. *Foliorum* petiolus 2 mm longus, dense ferrugineo-tomentosus; lamina chartacea, glabra, nervus medius pilosus, supra fusca, subtus brunnea, ovato-elliptica, basi obtusa, apice acuminata, 5,5 cm longa, 2,5 cm lata. *Flores* axillares solitarii; pedunculus 2 mm longus, ferrugineo-tomentellus; calyx cupularis extus pilosulus, bracteolati, lobis 3, circ. 3 mm longis, 2 mm latis; petala exteriora anguste lanceolata vel linearia-lanceolata, coriacea, minute pilosula, 22 mm longa, circ. 3,5 mm lata; petala interna 16-18 mm longa, circ. 2,5 mm lata, pubescentia; stamina ∞, 2 mm longa; carpella 8; ovarium dense pilosum, 1 mm longum; styli 4 mm longi, pilosi.

EST : Vohimarangitra (district de Tamatave), *Réserve naturelle* n° 1, R N 2440 bis (holotype P).

Observation. — Espèce proche du *X. madagascariensis* dont elle se distingue par le tomentum de couleur tan qui recouvre les jeunes rameaux et les pétioles, et par la pilosité de la nervure principale du limbe. En diffère également par ses fleurs à pédicelle beaucoup plus court, par la présence d'une bractée persistante qui entoure le calice, celui-ci étant plus large, à 3 lobes étalés et non dressés. Enfin, le style n'est pas muni de ponctuations glandulaires.

Xylopia Lastelliana Baill. var. **acuta** Ghesq. nom. nud. msc. in herb., ex Cavaco et Keraudren, var. nov. a var. *Lastelliana* differt foliis anguste acutatis, floribus parvioribus.

Est : Antalaha, *Perrier* 4940 (holotype P).

Centre : haute Maevarano, vallon d'Ambatohafo, alt. 1250 m, *Humbert* 25381.

Xylopia flexuosa Diels var. **latiflora** Ghesq. nom. nud. msc. in herb., ex Cavaco et Keraudren, var. nov., a var. *flexuosa* differt floribus majoribus, petalis latioribus.

Est : Pointe de Farafangana, *Decary* 5570 (holotype P).

Liste des collecteurs des *Annonacées* et des numéros de récolte.

Alleizette (1906) : 1330, 1326, Desmos chinensis; 1455, Artabotrys mabifolius; sans numéro, Cananga odorata.

Baron (1880-1900) : 5992, Xylopia buxifolia; 57, Artabotrys scytophyllus; 4773, Popowia Boivini; 5946, P. Gerrardii var. microsperma; 1590, Annona reticulata.

Bernier (1848) : 131, Isolona madagascariensis.

Boivin (1847-1852) : 2114ter, Artabotrys madagascariensis; A. Hildebrandtii sans numéro; 2114ter, mais différent du numéro précédent; Popowia pilosa; sans numéro, P. maritima; sans numéro, P. Boivini; 3287, 3288, Annona chrysophylla; 2115, A. chrysophylla var. porpetac; sans numéro, A. glauca var. minor; 3287, A. squamosa.

Capuron (1954) : 8941, Isolona Capuronii ; 8587, I. Ghesquierei var. longipedicellata ; 6751, Uvaria combretifolia ; 502. 6902,

U. manjensis; 8997, 9110, Xylopia Capuronii; 9077, 9159, X. beananensis; 8778, 9087, X. Lamii; 8674, 8764, X. pseudolemurica; 8815, X. microphylla; 8960, 9038, 9103, 9145, X. fananehanensis; 11370, X. sahafariensis; 194, 6864, X. bemarivensis; 8627, 8860, X. Dielsii; 11676, Artabotrys scytophyllus; 8604, 8987, Popyalthia emarginata; 11795, P. Capuronii; 8792, P. Humbertii; 9108, P. Leandrii; 848, 8619, P. ghesquiereana; 195, Popowia pilosa; 8751, P. Capuronii.

Chapelier (vers 1800) : Sans numéro, Hexalobus callicarpus; Polyalthia Chapellieri et Popowia pilosa.

Cloisel (?) : 142, Xylopia Humblotiana.

Commerson (vers 1771) : Sans numéro, Uvaria Commersoniana et Xylopia amplexicaulis.

Cours (1943) : 2964, Uvaria marenteria; 2519, Xylopia Lamii; 2571, X. Humblotiana; 3217, X. buxifolia; 802, 2288, Artabotrys mabifolius; 3623, A. mabifolius var. intermedius; 553, A. madagascariensis; 2840, Popowia Cousii.

Decary (1920-1933) : 14881bis, Uvaria Decaryana; 5570, Xylopia flexuosa var. latiflora; 4889, X. bemarivensis; 16289, 16336, 16393, Artabotrys scytophyllus; 15561, 15662, A. madagascariensis; 1079, A. Hildebrandtii; 1394, 14803, Popowia pilosa; 1378,14866,15868,15876,17854, P. sororia; 4248, P. micrantha.

Desvaux (?) : 329, Miliusa indica.

Decorse : Sans numéro, Popowia Boivini.

Du Petit Thouars (1795-1796) : Sans numéro, Uvaria furfuracea, U. marenteria, Xylopia Humblotiana, Cananga odorata, Annona squamosa.

Elliott (vers 1890) : 2461, Popowia micrantha.

Geay (1909) : 7505, 7544, 8012, 8125, Xylopia Humblotiana; 7063, Popowia Gerrardii; 7360, var. microsperma.

Greve (?) : 21, Popowia Greveana.

Hildebrandt (1879-1881) : 3044, Artabotrys madagascariensis; 3274, A. Hildebrandtii; 3400, Polyalthia Richardiana; 3290, Popowia pilosa; 3360, 3250, P. Boivini; 3236, Annona reticulata.

Grandidier (1865) :

Humbert (1922-1953) : 19247 bis, Uvaria amplexicaulis; 18964, U. Humberti; 19198, U. marenteria var. acuta; 17980,

Xylopia Humbertii; 20610 bis, 22831, X. buxifolia; 25381, X. Lastelliana var. acuta; 1044, Hexalobus callicarpus; 2874, 4977, 19422, 28641, Artabortys scytophyllus; 19056, A. mabifolius var. Villosus; 24473, A. mabifolius var. intermedius; 13749, 14085, 17486, 19725, 29058, A. madagascariensis; 24243, Polyalthia Ghesquiereana; 20607, Popowia pilosa; 4022, P. heterantha; 24174, P. Humbertii; 28717, 29621, P. valida; 20772, P. micrantha; 25585, P. caesia; 18889, P. caesia var. subacuta; 19049, 244451, Annona chrysophylla; 23195, A. chrysophylla var. porpetac.

Humblot (vers 1882) : 209, Uvaria marenteria; 117, Xylopia Humblotiana; 1565, Artabotrys uncinatus; 1578, Polyalthia Humblotii.

Lam et Meeuse (1938) : 5971, Xylopia Lamii; 6053, X. buxifolia; 6047, Polyalthia Lamii.

De Lastelle (?) : Sans numéro, Xylopia Lastelliana.

Lavanchie (1905) : Sans numéro, Artabotrys uncinatus et Polyalthia Humblotii.

Leandri (1932 et 1953) : 1932, Uvaria combretifolia; 859, U. Leandrii; 1051, 2006, 2081, U. amplexicaulis; 2299, U. manjensis; 2229, Xylopia bemarivensis; 1634, Artabotrys mabifolius; 296, A. madagascariensis; 1903, 2152, Polyalthia Henrici; 985, 1202, Popowia Boivini.

Louvel (vers 1924) : 227, Xylopia Lastelliana.

Perrier de la Bâthie (1897-1926) : 1511, Isolona Humbertiana; 1511 bis, 4951, 18714, I. Perrieri; 4946, 4950, Uvaria combretifolia; 2272, U. lemurica; 1806, U. ambongoensis; 1835, 4963, U. ambongoensis var. sciocarpa; 1743, U. amplexicaulis; 14022, 18362, U. acuminata; 1758, U. diplocampta; 14189, U. marenteria; 14976, U. marenteria var. obtisiuscula; 4958, U. Bathiei; 14057, Xylopia flexuosa, 4973, X. flexuosa var. latiflora; 4966, X. sericolampra; 1167, 1352, 4945, 4961, X. bemarivensis; 4975, X. lemurica; 1327, 4939, 4941, 14190, 15998, 18196, X. Humblotiana; 14912, 17549, X. buxifolia; 4944, X. Lastelliana; 4940, X. Lastelliana var. acuta; 4936, 16745, X. Perrieri; 4972, Artabotrys scytophyllus; 4937, Artabotrys mabifolius; 5001, 18715, A. luxurians; 1040, 1267, 4954, 4971, 13197, 14659, A. madagascariensis; 4967, A. Hildebrandtii var. Bathiei; 14910, Polyalthia emarginata; 4942, P. heteropetala; 508, 508 bis, 2283, 4959, 4960, 4969, 12337, P. Henrici; 4974,

P. decora; 68, P. oligosperma; 4935, P. Dielsii; 4947, Popowia malacophylla; 414, 414 bis, 4948, 4957, 4962, P. sororia; 18826, P. ambrensis; 4955, P. podocarpa; 16989, P. brachytricha; 419, 419 bis, 2297, 4952, P. Boivini; 4959, P. Boivini var. brevipedicellata; 1301, 4949, 4964, P. valida; 2082, 13258, 14221, P. Gerrardii; 1192 bis, P. caesia; 15134, 15545, P. caesia var. elongata; 4943, 4970, P. Greveana; 4968, Annona chrysophylla; 7109, A. chrysophylla var. porpetac.

Perville (1853) : 675, Uvaria ambongoensis; 247, 396, Artabotrys madagascariensis; 602, Popowia heterantha; sans numéro, P. Boivini; 374, P. glaucocarpa; 362, Annona chrysophylla var. porpetac.

Poisson (1922) : 83, Popowia heterantha.

Réserves naturelles : 3015, Isolona madagascariensis; 1303, Uvaria Saboureani; 3231, 3681, Xylopia flexuosa; 1665, 4737, Xylopia sericolampra; 2440 bis, X. Ghesquiereana; 1881, X. bemarevensis; 3743, X. lemurica; 2440, X. madagascariensis; 6953, X. Lastelliana; 2458, X. buxifolia; 2608, 2860, 3241, 3254, 7684, Polyalthia Ghesquiereana; 2725, P. Dielsii; 4338, Popowia pilosa; 1070, P. sororia; 7092, P. madagascariensis; 6230, P. Boivini.

Richard (1840) : Sans numéro, Polyalthia Richardiana; 214, Annona chrysophylla; 353, Miliusa indica.

Saboureau (1949) : 4348, Popowia Boivini var. brevipedicellata; 7918, P. Gerrardii.

Service forestier : 4893, 5382, 6373, 13073, Isoloma madagascariensis; 12451, I. Ghesquierei; 7189, I. Perrieri; 14194, Uvaria combretifolia; 44, 93, U. ambongensis; 4987, 5309, 13245, U. manjensis; 2957, 14512, Xylopia flexuosa; 6123, X. flexosa var. latiflora; 114, X. sericolampra; 3878, 4842, 5539, 7247, 7962, 10284, 14246, X. ambangensis; 2630, X. Danguyella; 7888, X. pseudolemurica; 48, 2205, 4591, 4701, 8073, 8103, 8066, 10275, 12646, X. bemarivensis; 3318, 3728, 14742, X. lemurica; 2380, X. Dielsii; 92, 1120, 1787, 1873, 2288, 3206, 4863, 7008, 8094, 9604, 12989, 13991, 4912, X. Humblotiana; 1358, 2287, 4225, 4262, 4389, 5613, 5749, 5869, 6577, 7293, 7418, 7497, 7512, 7580, 8093, 8126, 9940, 10829, 11110, 12152, 12170, 14141, 14921, 15108, X. buxifolia; 12497, X. Lastelliana; 11062, X. Lastelliana var. acuta; 4246, 4790, X. Perrieri; 12360, 14309, Artabotrys scytophyllus; 6587, 7495, Polyalthia

emarginata; 14599, P. madagascariensis; 9596, P. Capuronii; 72, 103, 2068, 2570, 6825, 6758, 8054, 8058, 7942, 12019, P. Henrici; 13087, P. Perrieri; 6118, 7673, 11075, P. Ritchardiana; 3814, 4814, 11035, P. oligosperma; 10736, P. Lamii; 5148, P. Leandrii; 1108, 12910, 15214, 15326, P. Ghesquiereana; 5409, Popowia pilosa; 15301, P. Capuronii; 25, 2260, 7380, P. valida; 1991, 4670, 6318, 6455, 12583, 12990, 15383, 14256, P. Gerrardii; 4314, Annona squamosa.

Swingle et Humbert (1943) : 4977, Artabotrys scytophyllus.

Thouvenot (1919) : 94, Xylopia Danguyella; 94 bis, X. Perrieri; 62 bis, Polyalthia emarginata; 62, P. oligosperma.

Ursch (1926) : 245, Xylopia Danguella; 63, X. Lastelliana; sans numéro, Polyalthia oligosperma; sans numéro, P. Lamii; 114, Popowia Gerrardi; 216, Annona chrysophylla.

Viguier (1912) : 1044, Hexalobus callicarpus.

Liste alphabétique des noms vernaculaires

Amaninombilahy : Xylopia bemarivensis.
Amaninomby : Xylopia buxifolia, X. bemarivensis.
Ambaviala : Xylopia fananehanensis.
Ambavy : Polyalthia emarginata, P. Richardiana, P. oligosperma, P. Ghesquièreana.
Flandriambarika : Xylopia bemarivensis.
Fandribasika : Xylopia bemarivensis.
Fanote : Popowia pilosa.
Fontsimavo : Xylopia Danguyella.
Fotsiavadika : Popowia pilosa, P. sororia.
Fotsimavo : Xylopia flexuosa var. latiflora, X. ambanjensis, X. buxifolia, X. Humblotiana.
Fotsivavy : Xylopia Humblotiana.
Hafotramkora : Polyalthia Perrieri.
Hazoambo : Xylopia ambanjensis, X. buxifolia, X. beananensis, X. Danguyella, X. fananehanensis, X. Dielsii, X. flexuosa, X. Humblotiana, X. Lamii, X. Lastelliana, X. pseudolemurica.
Hazombola : Xylopia ambanjensis, X. flexuosa.
Hazoambomena : Xylopia Ghesquiereana.
Hazomby : Polyalthia oligosperma.
Hazompoty : Uvaria combretifolia.
Ilang-ilang : Cananga odorata.
Kililo : Isolona madagascariensis.
Konokonombazaha : Annona squamosa.
Koropetaka : Annona chrysophylla.
Lambomalinike : Uvaria manjensis.
Lompingo : Xylopia sericolampra.
Maitsoririnina : Xylopia flexuosa.
Mavoha : Xylopia ambanjensis, X. bemarivensis, X. Humblotiana, X. Lastelliana.
Morangabe : Xylopia buxifolia.
Morangalahy : Xylopia Humblotiana.

Morangavavy : Xylopia flexuosa var. latiflora.
Ombavy : Isolona madagascariensis, Polyalthia Lamii, P. Ghesquiereana.
Ramiavona : Xylopia bemarivensis, X. buxifolia.
Rangomanitra : Popowia madagascariensis.
Relambo : Uvaria manjensis.
Rengitra : Xylopia buxifolia.
Robavy : Polyalthia madagascariensis, P. oligosperma, P. Leandrii, Popowia Capuronii.
Roimbavy : Isolona madagascriensis.
Taimpapango : Xylopia bemarivensis.
Tanoty : Popowia pilosa.
Tsiavalika : Popowia valida.
Vahimanbavy : Artabotrys mabifolius.
Vahimety : Artabotrys madagascariensis.

Index bibliographique.

(1) Baillon. — Mémoire sur la fam. des Anonac., *Adansonia,* VIII, pp. 162-184 et 295-344 (1867).
(2) Baron. — Compendium des plantes malgaches, *Rev. de Madagascar,* II, pp. 9-10 (1900).
(3) Bentham et Hooker. — Anonaceae, pp. 20-29 (1862).
(4) Cain. — Foundation of plant geography, New York (1944).
(5) Croizat. — Manual of Phytogeography, The Hague (1952).
(6) Du Toit. — Our wandering continents, London (1937).
(7) Engler & Diels. — Monogr. Afr. Anonac., pp. 1-96 (1901).
(8) Ghesquière. — Notes synonym. sur quelq. Annonac. d'Afr., *Rev. Zool. Bot. Afr.,* XXXII, I, pp. 139-142 (1939).
(9) Good. — A theory of plant geography, *New Phytologist,* XXX, pp. 149-171 (1931).
— The geography of the flowering plants, London (1947).
(10) Guinochet. — Logiq. et Dynam. du peupl. Végét., Paris (1955).
(11) Guppy. — Observations of a naturalist in the Pacific, etc., London (1906).
(12) Hoffman. — Sertum Plantarum Madagascariensium, pp. 315-316 (1801).
(13) Hutchinson. — Contrib. phylogen. classific. Flow. pl. II, *Kew Bull.,* 1923, pp. 241-261.
(14) Newbigin. — Geografia de plantas y animales (traduction espagn., Mexico) (1949).
(15) Palacky. — Catalogus Plantarum madagascariensium, V, pp. 3-5 (1907).
(16) Sinclair. — A revis. of Malayan Annonac., *Gard. Bull. Sing.,* XIV, p. 149 (1955).
(17) Willis. — Age and Area, Cambridge (1922).
(18) Wulff. — An introduct. to histor. pl. geogr., Waltham (1943).

NOTES ON *RUBIACEAE* FOR THE « FLORA OF WEST TROPICAL AFRICA » — I

BY

R. W. J. KEAY.

IXORA Linn.

Ixora brachypoda DC., Prod., IV, p. 488 (1830).

I. radiata Hiern in Oliv., Fl. Trop. Afr., III, p. 163 (1877); Hutch. et Dalz., Fl. W. Trop. Afr., II, p. 87 (1931).

Type : Senegal, Casamance, *Perrottet* et *Leprieur* s.n. (G — DC. !).

Prof. Baehni has very kindly sent me on loan a leaf and two fruits from the two type specimens of *Ixora brachypoda* DC., together with a photograph of both specimens. These show clearly that *Ixora brachypoda* DC. is the common West African species usually known by the name *I. radiata* Hiern.

In the Flora of Tropical Africa (1877) Hiern regarded *I. brachypoda* DC. as a synonym of *I. laxiflora* Sm., but he did not see De Candolle's type specimen. In the Flora of West Tropical Africa (1931), Hutchinson and Dalziel divided Hiern's *I. laxiflora* into two species and applied the name *I. brachypoda* to the segregate; again, it seems, without seeing De Candolle's type. I regard the specimens of Hutchinson's *I. brachypoda* as coming well within the range of *I. laxiflora* Sm.

Ixora delicatula KEAY. sp. nov., ab *I. guineensi* BENTH. foliis membranaceis, nervis lateralibus primariis 10-16, paniculis gracilioribus lobis corollae duplo longioribus differt.

Frutex erectus usque 2 m altus. *Ramuli* glabri vel sparsissime puberuli, stipulis ovatis 3-5 mm longis, basi connatis, apice apiculatis praediti. *Folia* glabra, petiolis 3-5 mm longis instructa; laminae membranaceae siccitate pallide virides, ellipticae vel oblongo-ellipticae vel lanceolatae, 6-14 cm longae, 2-5.4 latae, basi cuneatae vel obtusatae, apice longe et acute acuminatae; costa utrinque prominens, utrinsecus nervis lateralibus primariis 10-16 patentibus vix prominulis instructa. *Panicula* trichotoma, gracilis, quam folia multo brevior, minute puberula vel subglabra; peduncula 1-19 mm longa, apice bracteis subulatis 1-2.5 mm longis et stipulis ovatis circiter 2 mm longis et latis praedita, in ramulis primariis 8-12 mm longis et nonnunquam eis secundariis usque 8 mm longis ramosa; pedicelli (0-)1-3(-4.5) mm longi, apice bracteolis subulatis circiter 1 mm longis praediti. *Ovarium* circiter 0.7 mm longum, sparse et minute puberulum. *Calyx* 0.6-1 mm longus, in lobis triangulario-ovatis divisus, pilis minutis raris instructus. *Corollae* albidae glabrae tubus 10-11 mm longus, circiter 0.7 mm diametro; lobi lineares apice rotundati, 9-11 mm longi, usque 2 mm lati. *Stamina* filamentis 3 mm longis fauce corollae affixa, antheris linearibus circiter 6.5 mm longis praedita. *Stylus* glaber e fauce corollae circiter 5.5 mm exsertus, apice in 2 lobis circiter 2 mm longis divisus.

EASTERN NIGERIA : Degema District, 1916, *Talbot* 3822 (BM, holotype), A.17 (BM).

BRITISH CAMEROONS : Kumba Division, South Bakundu Forest Reserve, near Banga, Jan. 1951, *Keay* FHI 28568 (K).

Ixora nigerica KEAY, sp. nov., ab *I. nimbana* SCHNELL foliis subtus dense et molliter tomentello-puberulis, pedunculis longioribus, corollis brevioribus in alabastrum acuminatis differt.

Frutex circiter 2 m altus. *Ramuli* dense et molliter puberuli, stipulis ovatis acuminatis carinatis sparse puberulis praediti. *Folia* coriacea vel subcoriacea, oblongo-elliptica, 12-30 cm longa, 3.5-8.5 cm lata, apice abrupte et longe acuminata, basi cuneata in petiolam usque 1 cm longam decurrentia; pagina superior glabra, costa impressa; pagina inferior ubique ad senectute dense et molliter

tomentello-puberula, costa valde prominente nervis prominentibus instructa; nervi primarii laterales 12-15-jugi, arcuati, adscendentes sub marginem anastomosantes et conjugentes. *Panicula* ubique dense puberula, trichotoma, usque 25 cm diametro, basi pare foliorum 1.5-2 cm longorum sustentata; peduncula 13 cm usque (in *Ujor* FHI 30176) ad 31 cm longa, in ramulis primariis 2.5-5.5 cm longis, eis secundariis 2-4 cm longis et eis tertiis quartiisque 1-2 cm longis ample ramosa; bractei patentes, 1-5 mm longi; pedicelli 0-1 (-4.5) mm longi, apice bracteolis circiter 2 mm longis praediti. *Ovarium* dense patento-puberulum, circiter 1.5 mm longum. *Calyx* dense patento-puberulus, tubo circiter 0.4 mm longo, 2 lobis ovato-triangularibus circiter 1 mm longis et 2 lobis vix 0.6 mm longis instructus. *Corollae* tubus 19-20 mm longus, circiter 1 mm diametro, extra patento-puberulus intus glaber; lobi lanceolati apice acuminati, 8 mm longi, usque 3 mm lati, parte in alabastrum exposito patento-puberuli, intus basin versus pilis longis paucis vestiti. *Stamina* fauce corollae affixa, filamentis 1.2 mm longis, antheris linearibus circiter 11 mm longis praedita. *Stylus* glaber e fauce corollae circiter 5 mm exsertus, apice anguste clavatus, in 2 lobis circiter 2 mm longis divisus.

Eastern Nigeria : Ogoja Province, Obubra Division, Ukpon Forest Reserve, near Iyamoyong, July 1952, *M. G. Latilo* FHI 31875 (K, holotype); Calabar Province, Itu Division, Umon-Ndealichi Forest Reserve, June 1952, *E. Ujor* FHI 30176 (K).

Observations. — 1. — This plant grows in moist high forest. The collectors' notes indicate that the corolla tube and outside of the lobes are red, but the inside of the lobes is white.

2. — This is the only hairy species of *Ixora* in the F. W. T. A. area. Although I have not been able to see authentic material of all the tropical African species described from outside the F. W. T. A. area, I have not found any descriptions which matches *I. nigerica*.

Ixora Baldwinii Keay, sp. nov., ab *I. laxiflora* Sm. foliis basi latioribus, nervis lateralibus primariis anastomosantibus et conjugentibus paucioribus differt.

Frutex omnino glaber. *Ramuli* siccitate brunneo-purpurascentes, stipulis triangulario-lanceolatis circiter 2.5 mm longis praediti. *Folia* petiolis 2-4 mm longis instructa; laminae papyraceae oblongo-ellipticae vel ovato-oblongae, 3-8.7 cm longae, 1.4-4.3 cm latae,

basi rotundatae vel obtusatae, apice longe acuminatae; pagina superior siccitate olivacea costa nervis venulisque satis obviis sed haud prominentibus instructa; pagina inferior siccitate brunnea et nitens, costa nervisque prominentibus instructa; nervi laterales primarii 2-5-jugi, eis basi sub marginem anastomosantibus et ad apicem adscendentibus, ceteris arcuatis inter marginem et costam valde conjugentibus et anastomosantibus. *Panicula* trichotoma, basi pare foliorum ovatorum subsessilorum 3.3-4.3 cm longorum, 1.9-2.3 cm latorum sustentata; peduncula circiter 4.5 cm longa, in ramulis primariis 9-13 mm longis et eis secundariis 4-7 mm longis laxe ramosa; bractei patentes 1-3 mm longi; pedicelli 2.5-5 mm longi, apice bracteolis 1-1.5 mm longis praediti. *Ovarium* circiter 1 mm longum. *Calyx* tubo circiter 0.3 mm longo, lobis triangularibus circiter 0.7 mm longis instructus. *Corollae* tubus 28-30 mm longus, circiter 0.7 mm diametro; lobi lanceolati 11 mm longi, usque 2.75 mm lati, in alabastrum valde acuminati. *Stamina* fauce corollae affixa, filamentis vix 0.4 mm longis, antheris linearibus circiter 40 mm longis praedita. *Stylus* e fauce corollae circiter 4 mm exsertus, apice anguste clavatus, in 2 lobis circiter 1.5 mm longis divisus.

Liberia : Sinoe County, Jaurazon, Mar. 1948, *Baldwin* 11446 (K, holotype).

Observations. — 1. — The collector did not record the colour of the flowers on his label. The corollas have dried a deep red colour but that does not necessarily mean that the fresh colour was red.

2. — The following Kew specimens, also from Liberia, may belong to this species, but as they lack flowers it is difficult to be sure : *Baldwin* 6047, 6095, 6312, *Cooper* 361, *Linder* 106.

TARENNA Gaertn.

Tarenna Vignei Hutch. et Dalz. var. **subglabra** Keay, var. nov., a typo foliis subtus subglabris distinguenda.

Sierra Leone : Gola Forest, between Zimi and Gorahun, Apr. 1939, *Deighton* 3640 (K), 3685 (K, holotype of variety); Gola Forest, *Small* 554 (K, P, BR).

Liberia : Western Province, Kolahun District, Vahon, Nov. 1947, *Baldwin* 10248 (K); Eastern Province, Tchien District, Zeahtown, Aug. 1947, *Baldwin* 6930 (K).

Ivory Coast : de Man à Danané, *Aubréville* 1033 (K, ex P).

Gold Coast : Tano-Nimri Forest Reserve, July 1937, *Foggie* FH 4459 (K); Ankasa Su, July 1912, *Chipp* 304 (K).

Tarenna gracilis (Stapf) Keay, comb. nov.

Webera gracilis Stapf, Journ. Linn. Soc. Bot., XXXVII, p. 106 (1905).

Tarenna gracilis Hiern ex A. Chev., Explor. Bot., p. 319 (1920), nomen nudum.

Tarenna gracilis (Stapf) A. Chev. ex Hutch. et Dalz., Fl. W. Trop. Afr., II, p. 76 (1931), in syn.

Tarenna nitidula Auct. non (Benth.) Hiern; Hutch. et Dalz. loc. cit., p.p.

Tarenna Thomasii Hutch. et Dalz., loc. cit., p.p. (*Scott Elliot* 5554).

Sierra Leone : Limba Country, woods near Bafodeya, Apr. 1891 (or 1892), *Scott Elliot* 5554 (K); Kenema, Apr. 1914, *Lane-Poole* 284 (K); Panguma, Apr. 1940, *Deighton* 3907 (K); Nyeminga, Apr. 1939, *Deighton* 3680 (K); Njala, Gbesebu, May 1937, *Deighton* 3438 (K); without locality, 1915, *N. W. Thomas* 10545 (K, BR).

Liberia : Sinoe Basin, 1904, *Whyte* s.n. (K, holotype); Sinoe County, Kulo, Mar. 1948, *Baldwin* 11426 (K).

Ivory Coast : dans l'Indénié, à Zaranou, mars 1907, *Chevalier 17623* (K, ex P).

Tarenna brachysiphon (Hiern) Keay, comb. nov.

Ixora brachysiphon Hiern in Oliv., Fl. Trop. Afr., III, p. 165 (1877); Hutch. et Dalz., Fl. W. Trop. Afr., II, p. 89 (1931).

Tarenna ombrophila Schnell, Bull. I. F. A. N., XVI, p. 85, fig. 4 (1954).

Tarenna tomensis Schnell, l.c., p. 81, fig. 3 (1954).

French Guinea : Nimba Mts., Apr. 1950, *Schnell* 5114 (P); Macenta, Feb. 1949, *Adam* 3885 (P).

Sierra Leone : without locality, *N. W. Thomas* 10045 (K); Bagroo River, Mar. 1861, *Mann* 792 (K, holotype).

PAVETTA Linn.

The Identity of *Pavetta genipifolia* Schumach.

The description of *Pavetta genipifolia* Schumach., Beskr. Guin. Pl., p. 78 (1827), is attributed entirely to Schumacher. No indication of the collector or locality is given, but from the introduction to the work one presumes that the specimen was collected by Thonning or Isert not very far from the coast between Accra (Gold Coast) and Ouidah (Dahomey). In response to recent enquiries, I have been informed that no type specimen for this species could be traced in Herb. Schumacher at Copenhagen.

Judging by Schumacher's description and the known geographical range of two related species of *Pavetta,* it seems to me that the name *P. genipifolia* has been misapplied in at least two different ways. Bentham in Hook., Niger Fl., p. 415 (1849), applies the name to specimens collected by T. Vogel in Sierra Leone and Gold Coast; these specimens, as pointed out by Hiern in Oliv., Fl. Trop. Afr., III, p. 176 (1877), are *P. corymbosa* (DC.) F. N. Williams (syn. *P. Baconia* Hiern).

Hiern (l.c. p. 175) applies the name *P. genipifolia* to two specimens from Sierra Leone collected by Afzelius and Barter; Bremekamp, Fedde Rep., XXXVII, p. 136 (1934), follows Hiern and cites only specimens from Sierra Leone. Next to it he mentions another species, *P. megistocalyx* K. Krause, from Gold Coast and Togo only. The two species, which I will refer to for the present by Bremekamp's numbers, are distinguished as follows :

Flowers in dense subglobose clusters; calyx lobes oblong to obovate-oblong, up to 11 mm long and 3 mm broad; corolla tube 16-22 mm long; upper surface of leaves glabrous except near the petiole . . . . . sp. No. 200 — Gold Coast and Togo.

Flowers in corymbose cymes; calyx lobes spathulate, up to 12 mm long and 5 mm broad; corolla tube 14 mm long; upper surface of leaves pilose . . . . . sp. No. 201 — Sierra Leone.

If the original description of *P. genipifolia* Schumach. is compared with the above key it will be seen to agree far more closely with sp. No. 200 than with sp. No. 201; this is what one would expect from the geographical point of view. For these reasons I am convinced that Hiern and Bremekamp were wrong in applying

the name *P. genipifolia* to the Sierra Leone plant which appears to be without a correct name; I am therefore publishing for it the name *P. leonensis,* thus :

Pavetta leonensis KEAY, sp. nov.

P. genipifolia AUCT. non SCHUM.; HIERN in OLIV., Fl. Trop. Afr., III, p. 175 (1877) p.p., quoad descr.; HUTCH. et DALZ., Fl. W. Trop. Afr., II, p. 91 (1931), p.p., quoad spec. ex Sierra Leone; BREMEKAMP, Fedde Rep., XXXVII, p. 136 (1934), p.p., quoad descr.

SIERRA LEONE : May 1857, *Barter* s.n. (K); near the top of Sugar Loaf Mt., Dec. 1891, *Scott Elliot* 4024 (K); Freetown, Dec. 1891, *Scott Elliot* 3947 (BM, holotype); Benikoro, Oct. 1914, *N. W. Thomas* 2886 (K, BR); Kent, Nov. 1952, *Tindall* 13 (K); Valunia Chiefdom, Nyandehun, July 1952, *Deighton* 5792 (K).

Observations. — 1. — Bremekamp (l.c. refers to this species as « *Pavetta genipifolia* SCHUM. ex BENTH. in HOOK., Niger Fl., p. 415 (1849), etc. ...; an SCHUM., Beskr. Guin. Pl., p. 78 (1827) ». Bremekamp's reference to Bentham in the Niger Flora is unnecessary and erroneous, for the Vogel specimens cited there are, as Hiern pointed out in Fl. Trop. Afr., III, p. 176, *Pavetta corymbosa* (DC.) F. N. WILLIAMS (syn. *P. Baconia* HIERN).

2. — Bremekamp states that « *Barter* 1857 » (i.e. *Barter* s.n., collected in 1857) in the Kew Herbarium was Hiern's lectotype. There is, however, no evidence that Hiern made such a choice.

3. — I have chosen as hotoltype of *P. leonensis* a specimen in the British Museum (*Scott Elliot* 3947) which Bremekamp cited under *P. genipifolia.*

4. — Another specimen in the British Museum collected by Afzelius in Sierra Leone, is labelled « *Pavetta genipifolia* SCHUM. non BENTH. ». In fact, however, it is « *P. genipifolia* BENTH. non SCHUM. »; that is, *P. corymbosa* (DC.) F. N. WILLIAMS. The *Afzelius* specimen cited by Bremekamp under *P. genipifolia* was in Berlin and, presumably, was not the same as the specimen in the British Museum.

Pavetta genipifolia SCHUMACH., Beskr. Guin. Pl., p. 78 (1827), sub « genipaefolia »; DC., Prod., IV, p. 492 (1830); HUTCH. et DALZ.,

Fl. W. Trop. Afr., II, p. 91 (1931), p.p., excl. spec. ex Sierra Leone.

Ixora genipifolia (Schum.) O. Ktze., Rev. Gen. Pl., I, p. 286 (1891).

Pavetta megistocalyx K. Krause, Engl. Bot. Jahrb., XLIII, p. 146 (1909); Bremekamp, Fedde Rep., XXXVII, p. 136 (1934), sub « megisthocalyx ».

Gold Coast : without locality, 1906, *Farmar* 431 (K); near Aburi, May 1898, *Johnson* 131 (K); Kwahu Hills, Apr. 1899, *Johnson* 905 (K); Akwapim, Akropong, May 1932, *Irvine* 1760 (K), and Jan. 1935, *Irvine* 2600 (K).

Togoland : without locality, *Baumann* 278 (K); Misahöhe, Dec. 1904, *Busse* (B, holotype of *P. megistocalyx* K. Krause, not seen, presumably destroyed).

Western Nigeria : Ondo Province, Oluwa Forest Reserve, near Ominla, July 1953, *Onochie* FHI 33413 (K).

Royal Botanic Gardens, Kew,
January 1957.

DEUX ESPÈCES NOUVELLES DU GENRE *ROTALA* L.

PAR

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I

En mars 1857, Welwitsch a herborisé en Angola, « ad stagna in insulis dictis Ilhas de Calemba flum. Cuanza », des spécimens d'une Lythracée auxquels il a attribué le numéro 2341. En ce qui concerne l'habitus et l'habitat, Welwitsch ajoute : « rarior ast caespitosa in Insula Calemba ad stagnorum margines ».

Au même mois, il a récolté, sous le numéro 2342, « in stagnis nunc exsiccantibus pr. Lagôa de Quibinda », d'autres échantillons appartenant à la même famille. Sur l'étiquette de la feuille d'herbier de l'Institut Botanique de l'Université de Lisbonne (LISU) qui les porte, on peut lire :

Aman. heterophylla n. spc. ?

Anne *Amania (Suffrenia) filiformis* var. nov. ?

« Hab. late caespitosa, semiimersa in inundatis circa Lagoa de Quibinda ».

Sur le papier d'un sachet, on trouve la description suivante :

« Calyx 4 lobus sine cornubus. Stamina 2 ad medium calycem inserta opposita inclusa lateralia. Petala adsunt (1). Stylus brevis. Capsula 2 valvata. Bracteae 2, minutae, caducae ».

(1) Cette mention aux pétales est rayée.

Les échantillons du n° 2341 sont tous plus petits que ceux du n° 2342, mais, sur l'étiquette du premier, Welwitsch a écrit : « Formae plures transitorum ad specimen n° 2342 ».

En avril 1860, le même collecteur a herborisé au district de l'Huilla une autre Lythracée à laquelle le numéro 2338 a été attribué. Sur l'étiquette, on peut lire la description suivante :

« Herbula ⊙, laxe caespitosa, vix sesquipollicaris, floribus roseo-purpureis, capsulisque demum atropurpurascentibus. Petala vix ulla, ast calycis plerumque purpurei.

Habit. in pascuis arenosis, aestate inundatis, juxta Rivum Monino, non infreq. est solumodo hoc loco a me visa ».

Sur la feuille à laquelle les échantillons sont attachés, on peut lire écrit au crayon :

Ammania tilaeoides Welw. 860 in diario itineris

« Planta fructificans *Tillaeam muscosam* fere exacte fingit. Folia apice truncata sive ustulato-praemorsa sed vix bifida ».

Et encore sur l'étiquette écrit aussi au crayon :

Suffrenia capensis Harv.

En 1794, Bellardi (Act. Taur. VII : 445, t. 1, fig. 1) a décrit sous le nom de *Suffrenia filiformis* une espèce habitant les rizières du nord de l'Italie. Plus tard, Harvey (Thes. Cap. II : 56, t. 189, 1863) a créé, dans ce genre, une autre espèce, *S. capensis*, pour des plantes récoltées à Draakensberg, dans l'État Libre d'Orange.

En étudiant les spécimens *Welwitsch* 2338, 2341 et 2342, Hiern (in Oliv., Fl. Trop. Afr. II : 468, 1871) a référé tous les échantillons de ces numéros à *S. filiformis* Bellardi, qu'il transfère dans le genre *Rotala*. Dans cette espèce, *S. capensis* Harv. était aussi incluse comme synonyme. *Rotala filiformis* (Bellardi) Hiern devient donc une espèce complexe où les plantes de l'Italie, celles d'Angola et celles du Cap étaient rangées.

Koehne (Bot. Jahrb. I : 167, 1881) partage le point de vue de Hiern. Cependant, cet auteur distingue chez *R. filiformis* (Bellardi) Hiern la forma *typica*, où les spécimens *Welwitsch* 2341 et 2342 sont inclus, et la forma *Hiernii* Koehne, créée pour le n° 2338.

Plus tard, Hiern (Cat. Afr. Pl. Welw. I, 2 : 372, 1898), bien qu'il remarque quant au n° 2342 « specimens quite like the Italian

form », range toutes les plantes récoltées en Angola par Welwitsch dans la forma *Hiernii* KOEHNE.

La comparaison des plantes de Welwitsch avec d'autres récoltées en Italie (in ... agri Vercellensis, Autumno 1876, *Dr. G. Giborlii* s.n., COI; Vercelli, September 1876, *R. Pirotti* s.n., COI) nous a montré tout de suite que les plantes africaines étaient distinctes des italiennes.

D'abord, en ce qui concerne le spécimen *Welwitsch* 2338, nous avons constaté que les individus qui le constituent sont de petites plantes cespiteuses, à tiges non filiformes ne dépassant guère 5 cm (« vix sesquipollicaris » d'après Welwitsch), à feuilles plus longues que les entre-nœuds, étroitement linéaires, se rétrécissant vers le sommet où elles sont bidentées ou bifides, et à fleurs rougeâtres, tandis que les plantes italiennes présentent des tiges filiformes, longues de 30 à 40 cm, des feuilles de 2-5 mm plus courtes que les entre-nœuds (celles du sommet exceptées), ovoide-oblongues, entières et obtusiuscules au sommet, et des fleurs verdâtres.

Ces différences montrent, d'une façon assez nette, que le spécimen *Welwitsch* 2338 ne peut pas être rangé dans l'espèce *R. filiformis* prise dans l'acception de Bellardi. D'autre part, nous avons constaté que ce spécimen est aussi assez distinct de ceux des numéros 2341 et 2342, pour qu'ils puissent être considérés comme appartenant tous à la même espèce.

L'étude de la description de *Suffrenia capensis* HARV., ainsi que l'examen de quelques plantes de l'Afrique du Sud (Transvaal, Witwatersrand distr., Benoni, *C. E. Moss* 11006, BM) qui s'accordaient entièrement avec la description, nous ont porté à conclure que cette espèce doit être considérée comme distincte. Étant donné que les échantillons du numéro 2338 s'harmonisent aussi avec la description et possèdent de grandes ressemblances avec les plantes de l'Afrique du Sud, nous avons été amenés à considérer ces plantes de Welwitsch comme appartenant à *Suffrenia capensis* HARV., qui doit, cependant, être transférée dans le genre *Rotala* :

Rotala capensis (HARV.) A. FERNANDES et A. DINIZ comb. nov.

Suffrenia capensis HARV., Thes. Cap. II : 56, *t. 189* (1863).

Rotala filiformis (BELLARDI) HIERN in OLIV., Fl. Trop. Afr. II : 468 (1871) pro parte quoad syn. *Suffrenia capensis* HARV.

Rotala filiformis (Bellardi) Hiern forma *Hiernii* Koehne, Bot. Jahrb. I : 168 (1881); in Engl., Pflanzenr. IV, 216 : 37 (1903); Hiern, Cat. Afr. Pl. Welw. I, 2 : 372 (1898) pro parte quoad specim. *Welwitsch* 2338.

Rotala capensis se trouve donc aussi en Angola, au district de l'Huilla, sur les rives du fleuve Monhino. Il est à remarquer que cette espèce n'a pas été herborisée en Angola une autre fois.

La comparaison des spécimens *Welwitsch* 2341 et 2342 avec les plantes italiennes appartenant à *Rotala filiformis* nous a amenés à conclure que les premières, en opposition avec les idées de Hiern et Koehne, doivent être séparées dans une espèce indépendante que, d'accord avec une des suggestions de Welwitsch, nous appelons *Rotala heterophylla*, puisque ce nom s'harmonise avec les caractères de variation foliaire montrés par la plante.

Rotala heterophylla Welw. ex A. Fernandes et A. Diniz sp. nov. — Pl. III.

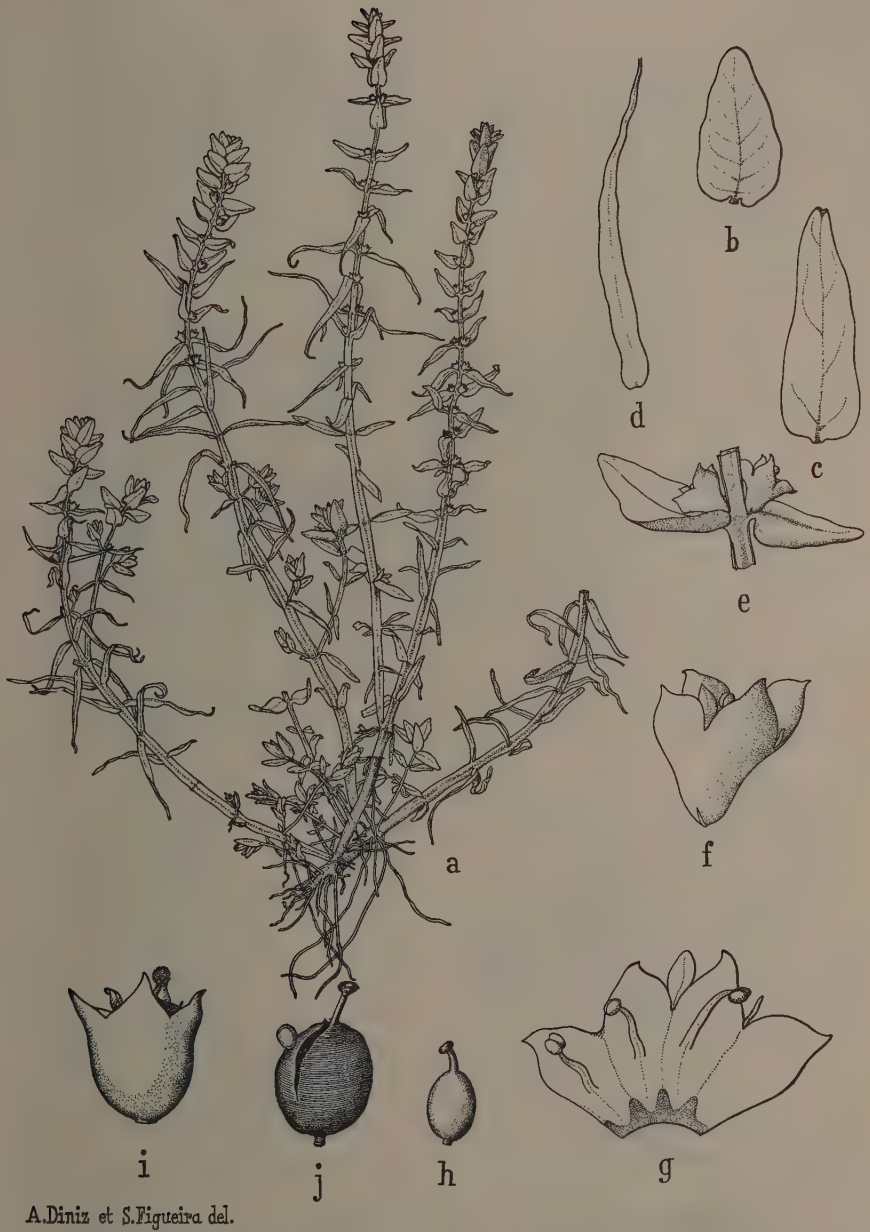
Ammannia heterophylla Welw. in schede.

Rotala filiformis (Bellardi) Hiern in Oliv., Fl. Trop. Afr. II : 468 (1871) pro parte quoad specim. *Welwitsch* 2341 et 2342.

Rotala filiformis (Bellardi) Hiern forma *typica* Koehne, Bot. Jahrb. I : 168 (1881); in Engl., Pflanzenr. IV, 216 : 37 (1903).

Rotala filiformis (Bellardi) Hiern forma *Hiernii* sensu Hiern, Cat. Afr. Pl. Welw. I, 2 : 372 (1898) pro parte quoad specim. *Welwitsch* 2341 et 2342.

Herba annua, caespitosa, semiimersa, 2,5-35 cm longa. *Caules* inferne plus minusve longe e nodis radicantes, tetragoni, simplices vel parce ramosi; internodia 2-10 mm longa interdum foliis breviora. *Folia* opposito-decussata, inferiora anguste linearia, plerumque supra medium involuta, basi rotundata, apice truncata vel emarginata vel bifida, usque 20 × 3 mm; media anguste ovata, apice emarginata; superiora ovata, basi cordata, apice obtusa, obscure penninervia, 3,5-5 × 2-3 mm. *Flores* 4-meri, sessiles, in axillis foliorum solitarii. *Bracteolae* 2, scariosae, minutissimae, subulatae. *Calyx* campanulatus, pallide roseus, circ. 2 mm longus, exappendiculatus,



Rotala heterophylla WELW. ex A. FERNANDES et A. DINIZ : a) Habitus (× 1); b) Folium superum (× 5); c) Folium medium (× 5); d) Folium inferum (× 5); e) Pars caulis cum floribus in axillis foliorum (× 6); f) Flos (× 12); g) Calyx explanatus (× 12); h) Ovarium cum stylo (× 12); i) Calyx fructifer (× 12); j) Capsula dehiscens (× 12). — Specimen *Welwitsch* 2342.

lobis deltoideis, circ. 0,75 mm longis. *Petala* 0 vel 2-4 plus minusve evoluta, maxime 0,75 × 0,25 mm lobi aequantia. *Stamina* saepe 2, rarius 3, rarissime 4, paulo supra 1/2 tubi inserta. *Ovarium* ellipsoideum, 0,8 × 0,6 mm, leviter stipitatum; stylus ovarii 1/2 aequans. *Capsula* subglobosa vel ellipsoidea, 2 valvata, tubum calycis paulo superans.

Fl. et fr. : Mart.-Jun.

Angola :

Cuanza Borealis distr. : in Insula Calemba, flum. Cuanza, ad stagnorum margines, III-1857, *Welwitsch* 2341 (BM; LISU); in inundatis pr. locum dictum Lagoa de Quibinda, III-1857, *Welwitsch* 2342 (BM; LISU, typus).

Huilla distr. : in loco dicto Humbe pr. flum. Cunene, in coenis siccis, 13-VI-1937, *Exell et Mendonça* 2834a (COI); inter Ruàcaná et Humbe, 10-VI-1937, *Exell et Mendonça* 2904 (BM; COI; LISJC); in loco dicto Dongoena, Morro Calueco pr. flum. Cunene, alt. 1000 m, 10-VI-1937, *Gossweiler* 10892 (COI; K; LISJC).

Rhodesia Australis :

Salisbury distr. : loco dicto Parktown, 18-IV-1944, *F. C. Greatrex* (herbarii numerus 18412) (SRGH).

Affinis *R. filiformi* (Bellardi) Hiern pro parte quoad syn. *Suffrenia filiformi* Bellardi (sect. *Enantiorotala* Koehne, subs. *Suffreniopsis* Koehne, series 1) a qua caulibus crassioribus et plerumque brevioribus; foliis heteromorphis, inferioribus angustelinearibus usque ad 20 mm longis internodiis longioribus, plerumque supra medium involutis, apice bifidis nec homoeomorphis, ovatis usque 5 mm longis internodiis multo brevioribus, integris et acutiusculis; bracteolis brevioribus; calycibus late campanulatis nec tubuloso-campanulatis; petalis 0 vel 2-4 nec semper nullis; staminibus 2-4 nec semper 2; capsula subglobosa nec oblonga; etc. differt.

Affinis etiam *R. capensi* (Harv.) A. Fernandes et A. Diniz a qua caulibus robustioribus usque ad 35 cm nec usque ad 5 cm longis; foliis heteromorphis nec omnibus lineari-subulatis, apice truncatis vel emarginatis vel bifidis; bracteolis brevioribus; petalis 0 vel 2-4 nec semper nullis; staminibus 2-4 nec semper 2; annulo nectarifero squamulas gerente; capsula calycem non superante; etc. differt.

Rotala Robynsiana A. FERNANDES et A. DINIZ : a) Habitus (× 1,5); b) Folium (× 12); c) Flos cum bracteolis (× 12); d) Calyx explanatus (× 12); e) Ovarium cum stylo (× 12); f) Capsula dehiscens (× 20). — Specimen *Fl. Freyne* 48.

II

Grâce à l'obligeance de M. le Directeur de l'Herbier du Jardin Botanique d'Yangambi, nous avons eu la possibilité d'examiner une collection de Lythracées récoltées au Congo Belge. Parmi ce matériel, nous avons trouvé une autre espèce nouvelle de *Rotala*, appartenant aussi à la section *Enantiorotala* KOEHNE, subs. *Suffreniopsis* KOEHNE, series 1.

Rotala Robynsiana A. FERNANDES et A. DINIZ sp. nov. — Pl. IV.

Herba erecta vel ascendens usque ad 10 cm alta (vel ultra ?). *Caulis* inferne obscure tetragonus circ. 2 mm diam., radicans, superne tetragonus, infra medium satis ramosus, ramis erectis cauliformibus. *Folia* caulina 3na, ramea opposito-decussata, omnia sessilia, tenuissime penninervia, ovato-lanceolata, basi rotundata, apice obtusa, usque ad 3,5 × 1,25 mm, inferiora internodiis breviora, superiora subimbricata. *Flores* 4-meri, sessiles, axillares. *Bracteolae* 2, subulatae, cir. 0,5 mm longae, calycis 1/2 aequantes. *Calyx* campanulatus, sub anthesi 1 mm longus, exappendiculatus, lobis deltoideis, tubi longitud. subaequantibus. *Petala* nulla. *Stamina* 2, paulo infra ad 1/2 tubi inserta, antheris apicem loborum vix attingentibus. *Ovarium* ellipsoideum, 1/2 ovarii aequans. *Capsula* ellipsoidea, 2-valvata, exserta, 1,25 mm longa. *Semina* minuta, 0,25 mm longa.
Fl. et fr. ?

CONGO BELGICA :

KATANGA SUPERIOR DISTR. : in regione Dilolo, 1940, *Fl. Freyne* 48 (COI, typus; BR, YANG).

Affinis *R. heterophyllae* WELW. ex A. FERNANDES et A. DINIZ a qua habitu non caespitoso; caule robustiore ramosioreque; foliis omnibus similibus, ovato-lanceolatis apice non emarginatis, caulinaribus 3^{nis}; bracteolis longioribus; floribus minoribus, circ. 1 nec 2 mm longis; petalis semper omnibus nullis; staminibus semper 2; capsulis satis exsertis; etc. differt.

Affinis etiam *R. filiformi* (BELLARDI) HIERN (pro parte quoad syn. *Suffrenia filiformi* BELLARDI) a qua habitu erecto nec prostrato;

caule crasso satis ramoso usque ad 10 cm alto nec filiforme, simplice vel superne parce ramoso usque ad 40 cm longo; foliis minoribus (usque ad 3,5 nec usque ad 5 mm longis); caulinis 3^{nis} nec omnibus opposito-decussatis; floribus minoribus (cir. 1 nec 1,5-2 mm); etc. differt.

Nous sommes très heureux de dédier cette nouvelle espèce à M. le Dr. Walter Robyns, professeur à l'Université de Louvain et Président du Comité exécutif de la Flore du Congo Belge, au moment où l'on commémore la 25^{me} année de sa remarquable activité comme Directeur du Jardin Botanique de l'État de Bruxelles. Par ce simple acte de lui dédier le nom d'une espèce, nous désirons rendre à M. le Prof. W. Robyns un double hommage : hommage de la plus haute admiration, sympathie et estime pour le savant éminent, le professeur distingué et l'homme d'action extraordinaire à qui la Science Botanique doit tant, et hommage de la plus profonde gratitude pour l'aide qu'il a toujours bien voulu accorder au travail de l'Institut Botanique de l'Université de Coimbra.

THE IDENTITY OF *LEUCOCOREMA* RIDLEY (Icac.) WITH *TRICHADENIA* THWAITES (Flac.)

BY

C. G. G. J. VAN STEENIS,

Foundation Flora Malesiana, Leyden.

For tracing a plant-geographical delimitation of the Flora Malesiana I have made, in 1942-1944, a complete census of genera described or recorded from the Malaysian area with maps of their distribution. It appeared that several dozens of these genera were of doubtful status or referred to families to which they obviously do not belong.

During the past two decades a number of these genera have been « placed » and I have purposely been after the identity of those remaining which hunt, if type specimens could be laid hands on, was crowned with success.

In the majority of cases the erroneous placing was due to inaccurate observation and analysis, hence description; some were based on inadequate material, a practice for which I cannot enough warn against, specially in tropical floras.

It is remarkable that subsequent workers on families containing such wrongly placed genera, have either accepted and copied these generic descriptions or have satisfied themselves merely by pointing out that the genus obviously did not belong to their family, without giving a positive alternative which could be attained if the type has been inspected.

A few have still remained dubious and I am now in a position to elucidate the status of them viz of *Leucocorema* (vide infra),

a Papuan tree attributed by Ridley to the *Icacinaceae*, the type being in the British Museum.

I can confirm Dr Sleumer's doubt on its Icacinaceous nature (in the new edition of the Pflanzenfamilien vol. 12b, p. 395, 1942).

The photograph of the type showed an exact picture of the habit of the flacourtiaceous *Trichadenia philippinensis* MERR., a widely distributed species in the whole of East Malaysia and common in Papua. Mr Exell was so kind to confirm this generic identity by comparing the type sheet of *Leucocorema* with material of *Trichadenia*.

Ridley appears to have omitted to record the presence of stipules and has obviously misinterpreted the structure of the male flowers of which he had obviously only buds. He records 5 sepals, though the calyx is closed in bud and ruptures mostly into 2 unequal segments. The 5 petals he described to be densely white hairy inside; this hairiness is confined, however, to the closely appressed scales covering the centre of the petals. The hairy disk described by Ridley obviously represents the hairy rudiment of the ovary in *Trichadenia*.

Ridley has been singularly unfortunate with his proposed new genera; all seven created in his account of the Mt Carstensz expedition 1916 have now been reduced, four being removed to other families.

Fortunately no name changes are involved by the transfer of *Leucocorema* to *Trichadenia*, the synonymy running as follows :

Trichadenia philippinensis MERR. *Philip. J. Sc.* 4 (1909) *Bot.* 298; SLEUMER, Fl. Mal. I, 4 (1954) 39. — *Leucocorema latifolia* RIDL. *Trans. Linn. Soc. Lond.* II. *Bot.* 9 (1916) 29; SCHELLENB. *Bot. Jahrb.* 58 (1923) 166; SLEUMER, Pfl. Fam. ed. 2, 12b (1942) 392.

ADDITIONAL NOTES ON THE *ERIOCAULACEAE*. XII

BY

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Yonkers, New York

It is with exceedingly great pleasure that I accept the honor of presenting a paper for the volume of the Bulletin du Jardin Botanique de l'État dedicated to Professor Doctor Walter Robyns. Dr. Robyns has been a valued and respected friend and colleague of mine for the past twenty-five years. During this time he has accomplished noteworthy results in building up the botanical garden and museum of which he is serving as Director. His name will also remain forever indelibly associated with the flora of the Belgian Congo because of the monumental work which he has accomplished there. I wish for him very many more years of fruitful service in the cause of botanical science.

In 1937 I published a monograph of the *Eriocaulaceae* of North America in N. Am. Fl. 19 : 17-50. In the succeeding years much additional information and thousands of additional specimens have come to light and I expanded my work to embrace the family for the entire world. A series of papers was begun in 1939 recording this additional information. The present contribution is a part of this series. Previous parts have been published in *Phytologia,* 1 : 309-336 and 343-364 (1939), 3 : 178-192 (1949), 3 : 321-344 and 382-400 (1950), 3 : 468-472 and 491-502 (1951), 4 : 134-152 (1952), and 4 : 200-208, 295-304, and 311-341 (1953).

In order to make it easier for subsequent students of the group to assimilate these notes, the same format is employed here as in all previous parts of the series and the same abbreviations for the

names of books, periodicals, and herbaria are used as have been employed in all previous parts. Explanation in full for the abbreviations of herbaria will be found in *Phytologia* 4 : 154-159 (1955), with the following additions : Lz = A. Lutz Herbarium, Universidade do Brasil, Rio de Janeiro, Sk = University of Saskatchewan, Saskatoon, Saskatchewan, Canada, and Yu = T. G. Yuncker Herbarium, Greencastle, Indiana.

Eriocaulaceae LINDL.

Additional literature : L., Sp. Pl., ed. 1, 1 : 87. 1753; A. L. Juss., Gen. Pl. 44 & 447. 1789; RICH., *Ann. Mus. Hist. Nat. Paris* 17 : 465. 1811; POIR. in LAM., Encycl. Méth. Suppl. 3 : 162. 1813; KUNTH in BONPL. & HUMB., Nov. Gen. & Sp. Pl. 1 : 251-254. 1815; DESV., *Ann. Sci. Nat. Paris,* sér. 1, 13 : 37-52. 1828; BONG., *Mém. Acad. Imp. Sci. St. Pétersb.,* sér. 6, 2 : 219-237. 1832; MART., *Ann. Sci. Nat. Paris,* sér. 2, 2 : 25-43. 1834; LINDL., Nat. Syst. Bot., ed. 2, 387. 1836; ENDL., Gen. Pl. 122-123. 1836; LINDL., Veg. Kingd., ed. 3, 122. 1853; STEUD., Syn. Pl. Cyp. 2 : 267-281. 1855; KÖRN., *Linnaea* 27 : 561-692. 1856; KÖRN., Monog. Script. Erioc. 1-132. 1856; KÖRN. in MART., Fl. Bras. 3 (1) : 273-508. 1863; EICHL., Blüthendiag. 1 : 136-138. 1875; BENTH. & HOOK. f., Gen. Pl. 3 (2) : 1019-1025. 1883; HIERON. in ENGL. & PRANTL, Nat. Pflanzenfam. 2 (4) : 21-27. 1888; NIEDERLEIN, *Bot. Mus. Prod. Arg.* 3 (31) : 336. 1890; KUNTZE, Rev. Gen. Pl. 2 : 745-746. 1891; BAILL., Hist. Pl. 12 : 397-402. 1894; SCHINZ, *Bull. Herb. Boiss.* 4, App. 3 : 35. 1896; N. E. BR. in THISELT.-DYER, Fl. Cap. 7 : 54. 1897; RENDLE, Cat. Afr. Pl. Welw. 2 : 99-102. 1899; RUHL. in ENGL., *Bot. Jahrb.* 27 : 65-85. 1899 ; RUHL. in URB., Symb. Ant. 1 : 482-494. 1900 ; N. E. BR. in THISELT.-DYER, Fl. Trop. Afr. 8 : 230-264. 1901 ; FRITSCH, *Bull. Herb. Boiss.,* sér. 2, 1 : 1082-1119. 1901; BAUM, Kunene-Sambesi-Exped. 182. 1903; RUHL. in ENGL., Das Pflanzenreich 13 (4-30) : 1-294, figs. 1-40. 1903; ARECHAVALETA, *An. Mus. Nac. Montevid.* 4 : 1-24. 1903; RENDLE, *Journ. Linn. Soc. Lond. Bot.* 27 : 425-494. 1906 ; LECOMTE, *Bull. Soc. Bot. France,* 55 : 643-648. 1908; RUHL. in WETTST. & SCHIFFN., *Denksch. Akad. Wiss. Math.-Nat. Wien* 79 : 87-88. 1908; SMALL, Fl. Florida Keys 28 & 158. 1913; RUHL. in ENGL., *Bot. Jahrb.* 50, Suppl. 363-374. 1914; POLLARD in WEBSTER, New Internat. Dict. Eng. Lang. 745. 1917; HAUMAN, *Physis* 4 : 585. 1919; FYSON, *Journ. Ind. Bot.* 1 : 49-53, 2 : 133-150, 192-208, and 259-266. 1921; FYSON, *Journ.*

Ind. Bot. 3 : 12-18 and 91-115. 1922; Molfino, *Physis* 6 : 361-363. 1922; Fyson, Ind. Sp. Erioc. 1-88, pl. 1-51. 1923; Uphof, *Am. Journ. Bot.* 14 : 44-48. 1926; Molfino, *An. Soc. Cient. Arg.* 108 : 101-102. 1929; Rendle, Classif. Flow. Pl., ed. 2, 1 : 273-274 & 393. 1930; Ruhl. in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 15a : 39-57, figs. 16-25. 1930; Hauman, *Bull. Soc. Roy. Bot. Belg.* 64 : 41. 1931; Arwidsson, *Bot. Notiser* 1934 : 83-87. 1934; Malme, *Arkif för Bot.* 26a : 9. 1934; Herter, *Rev. Sudam. Bot.* 2 : 125. 1935; Engl. & Diels, Syllab. Pflanzenfam., ed. 11, 154. 1936; Moldenke, *N. Am. Fl.* 19 : 17-50. 1937; Moldenke, *Phytologia* 1 : 343-364. 1939; Moldenke in Lundell, Fl. Texas 3 (1) : 1-9. 1942; Parodi, *Darwiniana* 6 : 127-178. 1943; Hutchinson, Fam. Flow. Pl. 2 : 65-67. 1944; Wettst., Trat. Bot. Sist. 941-942. 1944; Moldenke in Woodson & Schery, *Ann. Mo. Bot. Gard.* 31 : 65. 1944; Moldenke, *Phytologia* 2 : 123-124. 1944; Moldenke, Known Geogr. Distrib. Erioc. 1-62. 1946; Abbiatti, *Rev. Mus. La Plata,* new ser., 6 : 340-341. 1946; Jacques-Felix, *Bull. Soc. Bot. France* 94 : 143-151. 1947; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 1-215. 1949; Moldenke, *Phytologia* 3 : 162-192. 1949; Moldenke, *Phytologia* 3 : 321-344 and 382-400. 1950; Moldenke, *Phytologia* 3 : 468-472 and 491-502. 1951; *Biol. Abstr.* 26 : 3530 & 3871. 1952; Moldenke, *Phytologia* 4 : 134-152. 1952; Moldenke, *Phytologia* 4 : 200-208, 295-304, and 311-341. 1953; Ducke & Black, *Bol. Tecn. Inst. Agron. Norte* 29 : 48, 53, & 62. 1954; Erdtman, *Bot. Notiser,* 1954 : 66 & 68. 1954; Hess. *Bericht. Schweitz. Bot. Gesell.* 65 : 115-204 and 263-271. 1955; F. C. Hoehne, Fl. Aquat. 88. 1955; *Biol. Abstr.* 27 : 3763. 1955; Moldenke in Humbert, Fl. Madag. 36 : 1-41. 1955; *Biol. Abstr.* 28 : 3203 & 3531. 1956.

Pollard, in the reference cited above, is authority for the claim that the words « eriocaulaceous », « eriocaulonaceous », and « Eriocaulaceae » are now accepted words in the English language. Erdtman reports, in the reference cited to him above, that members of this family have stenopalynous pollen of the spiraperturate type.

A revised key to the accepted genera of *Eriocaulaceae* follows :

1. Flowers imperfect.
   2. Stamen only 1 . . . . . *Comanthera.*
   2a. Stamens more than 1.
      3. Stamens 4 or 6, twice as many as the outer perianth-segments (rarely 3).
         4. Petals of both types of florets free . . . . . *Eriocaulon.*

4a. Petals of staminate florets connate into a tube . . . *Mesanthemum.*
3a. Stamens 2 or 3, as many as the outer perianth-segments.
5. All perianth-segments of both types of florets free . *Carptotepala.*
5a. Some perianth-segments connate.
6. Petals of pistillate florets not foliaceous, more or less reduced to hairs.
7. Petals of pistillate florets reduced to very small lobes which are long-pilose; stems long and floating . . . . . *Tonina.*
7a. Petals of pistillate florets reduced to hairs, those of staminate florets absent; stems very short . . . . *Lachnocaulon.*
6a. Petals of pistillate florets foliaceous.
8. Petals of pistillate florets free.
9. Hairs on perigonium and bractlets obtuse at apex, rarely subobtuse, granulose within, often tuberculate; style-appendages inserted at about the same level as the stigmas and between them; stigmas usually bifid.
10. Anthers with two theace . . . . . *Paepalanthus.*
10a. Anthers with one theca . . . . . *Blastocaulon.*
9a. Hairs always acute at apex, smooth within, not tuberculate; style-appendages inserted conspicuously beneath the stigmas; stigmas simple . . . . . *Leiothrix.*
8a. Petals of pistillate florets free at bose and apex, connate at the middle.
11. Anthers with 2 thecae, 4-celled; stamens 3 . . . . . *Syngonanthus.*
11a. Anthers with 1 theca, 2-celled stamens often 2 . . . . . *Philodice.*
1a. Flowers perfect . . . . . *Wurdackia.*

Carptotepala MOLDENKE.

This genus was originally proposed by me in *Fieldiana Bot.* 28 : 114 (1951). It was based on *C. insolita* MOLDENKE (1951), but an older name for this taxon proves to be *Paepalanthus jenmani* GLEASON (1929), so the latter now becomes the type species.

Carptotepala jenmani (GLEASON) MOLDENKE.

Synonymy : *Paepalanthus jenmani* GLEASON, *Bull. Torrey Bot. Club* 56 : 14. 1929. *P. chimantensis* MOLDENKE, in herb.

Collectors describe the roots as thickish and orchid-like; leaves borne in dense clusters, rigid, erect, firmly membranous or rigid-coriaceous, varying from rich- or pale-green to grass-green on both surfaces; involucre buff; heads white or gray-white with blackish on the outer parts at the base; flowers white or whitish; bracts gray-brown.

It has been collected at altitudes of 393 to 2600 meters, in anthesis from January to March and in July, August, October, and November, and in fruit in July. Steyermark records the vernacular name

« leut ». He also states that it forms dense mats on wet rocks at the base of waterfalls, that it is common along swift water and rapids, locally abundant in large colonies in rapid water among rocks, and found in the spray zone on top of waterfalls. Maguire found it on moist rocks, and Sandwith tufted in sand among boulders by falls. Maguire & Fanshawe found it by waterfalls, on sandstone savannas, and locally common by riversides. Steyermark & Wurdock describe it as locally frequent on moist mossy ground, in scrub forests, in dense cushions in thickets, in dry sand, and in large colonies in rapid water among rocks. On the label of their no. *365* they note that its « leaves narrower and caudex more elongate than *364* but probably only an ecological variant ». I agree with this conclusion.

The type of the species is *Jenman 1032*. *C. insolita*, on the other hand, was based on *Steyermark 60703* while *Paepalanthus chimantensis* was founded on *Steyermark & Wurdack 365*.

Citations : Venezuela : Bolivar : *B. Maguire 33516a* (N); *Steyermark 60703* (N), *74662* (Z), *76016* (Z), *76057* (Z); *Steyermark & Wurdack 72* (N), *364* (N), *365* (N), *476* (N).

British Guiana : *Jenman 1032* (K-type); *Maguire & Fanshawe 32312* (N), *32643* (N); *Sandwith 1258* (K); *Schomburgk s.n.* (K).

Comanthera linderi L. B. Sm.

Synonymy : *Syngonanthus akurimensis* Moldenke, *Phytologia* 2 : 371-372. 1947. *S. akurimensis* var. *amazonicus* Moldenke, *Phytologia* 3 : 42. 1948.

Literature : L. B. Sm., *Contrib. Gray Herb.* 117 : 38-39. 1937; Moldenke, *Phytologia* 2 : 371-372 (1947) and 3 : 32. 1948; Moldenke, *Known Geogr. Distrib. Verbenac.*, [ed. 2], 66 & 203. 1949; Moldenke, *Phytologia* 4 : 208, 296, & 338. 1953.

Syngonanthus akurimensis was based on *Tamayo 3234* from Venezuela, and its so-called variety *amazonicus* on *Fróes 22433* from Brazil. Both seem to exhibit no essential differences from Smith's type of *Comanthera linderi*. The species is said to inhabit sandy soil along riverbanks, and has been collected in anthesis in April and June. Irwin found it in sterile sand in open fully exposed positions. It has been confused in the past with *Syngonanthus simplex* (Miq.) Ruhl., while the Lockhart specimen cited below was mixed with material of *S. gracilis* (Körn.) Ruhl.

Sandwith, on a card addressed to me and dated May 12, 1956, states that this Lockart specimen certainly came from Caracas, Venezuela, rather than from Trinidad.

Citations : Venezuela : Bolivar : *Lasser 1705* (K, N, N, W-1901897); *Tamayo 3234* (F-photo, N, N-photo, W, Z-photo). Federal District : *Lockhart s.n.* [Caracas] (K).

British Guiana : *Irwin BG. 20* (W-2141414, Z); *Linder 40* (G-type); *Martyn 146* (K).

Brazil : Amazonas : *Fróes 22433* (N).

Eriocaulon Gron.

Additional literature : L., Gen. Pl., ed. 2, 35. 1742; L., Sp. Pl., ed. 1, 87. 1753; L., Gen. Pl., ed. 5, 38. 1754; L., Mant. 580. 1767; Hill, Herb. Brit. 1 : pl. 66. 1769; Huds., Fl. Angl., ed. 2, 414. 1778; R. Br., Prodr. Fl. Nov. Holl. 1 : 252-255. 1810; Desv., *Ann. Sci. Nat. Paris*, sér. 1, 13 : 47, pl. 5. 1828; Roxb., Fl. Ind. 3 : 612-613. 1832; Endl., Gen. Pl. 1 : 123. 1836; Lesson in Bougainville, Journ. Navig. Autour Globe Frêg. Thétis & Corv. l'Espérance 2 : 348. 1837; Kunth, Enum. Pl. 3 : 492-580. 1841; F. Muell., *Trans. Phil. Soc. Victor.* 1 : 23. 1855; Steud., Syn. Pl. Cyp. 2 : 268-283. 1855; Körn., *Linnaea* 27 : 561-692. 1856; Welw., Apont. Phyt.-geogr. 542. 1859; Körn. in Mart., Fl. Bras. 3 (1) : 274-507. 1863; Körn. in Miq., *Ann. Mus. Bot. Lugd.* 3 : 162-164. 1867; Böck, *Flora* 56 : 90. 1873; Franch. et Savat., Enum. Pl. Jap. 2 : 99-100. 1879; Benth. & Hook. f., Gen. Pl. 3 : 1020. 1883; Hieron. in Engl. & Prantl, Nat. Pflanzenfam. 2 (4) : 26. 1887; Chapm., Fl. South. U. S., ed. 2, 502-504 & 681. 1889; Mak., *Bot. Mag. Tokyo* 4 : 173-174. 1890; Morong, *Bull. Torrey Bot. Club* 18 : 353. 1891; Maxim., *Mél. Biol.* 13 : 5-28. 1892; Mak., *Bot. Mag. Tokyo* 8 : 506-507. 1894; Hook. f., Fl. Brit. Ind. 6 : 571-585. 1894; A. Gray, Field For. & Gard. Bot. 456 & 511. 1895; Britton & Br., Illustr. Fl., ed. 1, 1 : 371-373 & 602. 1896; Hook. f. in Trimen, Handb. Fl. Ceyl. 5 : 1-11. 1900; Ruhl. in Engl., *Bot. Jahrb.* 27 : 65-85. 1900; Dalla Torre & Harms, Gen. Siphonog. 53. 1900; Ruhl. in Engl., Das Pflanzenreich 13 (4-30) : 1-294. 1903; Matsumura, Ind. Plant. Japon. 2 (1) : 175-177. 1905; Stapf in Johnston, Liberia 2, app. 4. 1906; Robinson & Fern., Gray's New Man. Bot., ed. 7, 260-262 & 898. 1908; P. Henderson, Handb. Pl. 143. 1910; Lecomte, *Notul. Syst.* 1 : 191-192. 1910; Koord.,

Exkursionsfl. Java 1 : 271-275. 1911; Nakai, *Bot. Mag. Tokyo* 25 : 209-218, figs. 1 & 2. 1911; Nakai, *Journ. Coll. Sci. Imp. Univ. Tokyo* 31 : 281-283. 1911; E. D. Merr., Fl. Manila 135-136. 1912; Mak., Iinuma Somoku-Dzusetsu, rev. ed., 4 : 1159-1161, pl. 1034-1036. 1913; Britton & Br., Illustr. Fl., ed. 2, 1 : 453 & 678. 1913; Small, Fl. Miami 36-38 & 202. 1913; Nakai in Matsumura, Icon. Plant. Koisikav. 2 : 36 & 47, pl. 102 & 108. 1914; Pollard in Webster, New Internat. Dict. Eng. Lang. 745. 1917; Fyson, *Journ. Ind. Bot.* 1 : 49-53. 1919; Hayata, Icon. Plant. Formos. 10 : 49-56. 1921; Lecomte, Fl. Gén. Indochine 7 : 1-18. 1922; Mori, Enum. Pl. Corea 79-80. 1922; E. D. Merr., Enum. Philipp. Flow. Pl. 1-2 : 192-193. 1922; Ridl., Fl. Malay Penins. 5 : 133-136. 1925; Mak. & Nemoto, Fl. Jap., ed. 1, 1303-1308. 1925; Sasaki, List Pl. Formosa 99. 1928; Ruhl. in Engl., Nat. Pflanzenfam., ed. 2, 15a : 39-57. 1930; Sasaki, Cat. Govt. Herb. 118-119. 1930; Linder, *Contrib. Dept. Trop. Biol. & Med.* 5 : 513-568. 1930; Mak. & Nemoto, Fl. Jap., ed. 2, 1510-1515. 1931; Mayabe & Kudo, *Journ. Fac. Agr. Hokkaido Imp. Univ.* 27 : 286-288. 1932; Rydb., Fl. Prairies & Plains 198 & 940. 1932; Small, Man. Southeast. Fl. 257. 1933; Masamune, *Mem. Fac. Sci. Agr. Taihoku Imp. Univ.* 11, Bot. 4 : 536-538. 1934; House, Wild Fls. 44 & 347, pl. 6a. 1934; J. Hutchinson, Fam. Flow. Pl. 2 : 65-67. 1934; Steinberg in Komarov & Schischkin, Flora U. R. S. S. 3 : 494-498, pl. 27. 1935; Masamune, Short Fl. Formosa 262-263. 1936; Nemoto, Fl. Jap. Suppl. 1038-1040. 1936; Satake, Bot. Mag. Tokyo 51 : 285-291. 1937; Dinklage in Fedde, *Repert.* 41 : 235-271. 1937; Moldenke, N. Am. Fl. 19 : 17-37. 1937; Satake, *Journ. Bot.* 15 : 140-145 & 627-632. 1939; Moldenke, *Phytologia* 1 : 309-328, 1939; Honda, Nom. Pl. Japon. 461-463. 1939; Hylander, World Pl. Life 598 & 702. 1939; Satake, Rev. Jap. Eriocaul. 26-63. 1940; Sarake in Nakai & Honda, Nov. Fl. Jap. 6 : 4-76. 1940; Deam, Fl. Indiana 283-284 & 1191. 1940; Fassett, Man. Aquat. Pl., ed. 1, 169-170 & 368. 1940; Pool, Fl. & Flow. Pl. 295 & 407. 1941; Moldenke in Lundell, Fl. Texas 3 (1) : 3-4. 1942; A. R. Schultz, Introd. Estud. Bôt. Sist., ed. 2, 252, 279, & 539. 1943; Moldenke, *Ann. Mo. Bot. Gard.* 31 : 65. 1944; Muenscher, Aquat. Pl. U.S. 6, 12, 191-194, & 367. 1944; G. N. Jones, Fl. Illinois 88 & 306. 1945; León, Fl. Cuba 1 : 279-281 & 423. 1946; J. Hutchinson, Brit. Flow. Pl. 32, 252, & 370-371. 1948; Milne-Redhead, *Kew Bull.* 1948; 472. 1948; Fern., Gray's Man. Bot., ed. 8, 390-391 & 1596. 1950; *Biol. Abstr.* 26 : 3530 & 3872. 1952; Meikle & Baldwin, *Am.*

Journ. Bot. 39 : 44-51. 1952; SANTAPAU, *Anal. Bot. Cavanilles* 11 : 294. 1952; HERTER, *Rev. Sudam. Bot.* 9 : 187 & 197. 1954; *Biol. Abstr.* 25 : 4057. 1954; SANTAPAU, *Ind. Forester* 80 : 388. 1954; MOLDENKE in HUMBERT, Fl. Madag. 36 : 1-41. 1955; F. C. HOEHNE, Pl. Aquat. 88. 1955; SANTAPAU, *Journ. Gujarat Research Soc.* 17 : 56. 1955; *Biol. Abstr.* 27 : 3763 & 3765. 1955; HESS, *Bericht. Schweiz. Bot. Gesell.* 65 : 115-204 & 263-271. 1955; SANTAPAU & RANDERIA, *Journ. Bombay Nat. Hist. Soc.* 53 : 197. 1955; ROBYNS, Fl. Sperm. Parc Nat. Albert 3 : 314 & 559-560. 1955.

Eriocaulon abyssinicum HOCHST.

Additional literature : MOLDENKE, Known Geogr. Distrib. Eriocaul. 20-22 & 32. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 110, 112, 122, & 203. 1949; HESS, *Bericht. Schweiz. Bot. Gesell.* 65 : 160, figs. 2 & 3, and 165-167, pl. 9, figs. 8 & 9. 1955.

Hess, in the reference cited above, cites *Schimper 1944* from Abyssinia as the type, preserved in the De Candolle Herbarium at Geneva. He also cites *Rehmann 7297* from Natal and *s.n.* from Transvaal and his own *52/1941, 52/2017,* and *52/2021* from Huila, Angola. The species has been collected in sandy-limey soil at the margins of roadside ditches along with *E. buchananii* RUHL., *E. gilgianum* RUHL., *Eleocharis atropurpurea* KUNTH, *Eleocharis spongostyla* HESS, and various other sedges, grasses, and *Drosera* and *Utricularia* species, in water 1-2 cm deep, and in dried-up hollows in rocky plains. It is closely related to *E. welwitschii* RENDLE and to *E. gilgianum,* the former differing in its densely long-pilose receptacles and the latter in its long-ciliate sepals.

Eriocaulon achiton KÖRN.

Additional literature : FYSON, *Journ. Ind. Bot.* 2 : 202 & 204. 1921; MOLDENKE, Known Geogr. Distrib. Eriocaul. 23 & 32. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 124, 126, & 203. 1949; MOLDENKE, *Phytologia* 3 : 180-181 (1949) and 4 : 339. 1953; HESS, *Bericht. Schweiz. Bot. Gesell.* 65 : 178, 1955.

Smitinand reports the species as uncommon in savannas at 1300 meters altitude, blooming in September, with blackish heads.

Additional citations : INDIA : Bombay : *Santapau 17150* (Xa, Z). THAILAND : *Smitinand 1982* [Herb. Roy. Forest Dept. 9449] (Z).

Eriocaulon africanum HOCHST.

Additional literature : MOLDENKE, Known Geogr. Distrib. Eriocaul. 22, 32, & 41. 1946; MOLDENKE, Known Geogr. Distrib. Ver-

benac., [ed. 2], 119, 121, 122, & 203. 1949; MOLDENKE, *Phytologia* 3 : 181 (1949) and 4 : 339. 1953; HESS, *Bericht. Schweiz. Bot. Gesell.* 65 : 266-269. 1956.

Following Ruhland, I have hitherto regarded *E. tofieldianum* SCHINZ as a synonym of *E. africanum*. It appears, however, that the two are distinct entities, and Hess, in the reference cited above, gives a thorough discussion of the differences between the two. The binomial, *E. tofieldianum* SCHINZ, is, therefore, to be removed from the synonymy of *E. africanum*.

Eriocaulon afzelianum WIKSTR.

Additional literature : MOLDENKE, Known Geogr. Distrib. Eriocaul. 20, 21, & 32. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 109, 111, 112, & 203. 1949; MOLDENKE, *Phytologia* 3 : 181 (1949) & 321. 1950; MONOD, *Bull. Inst. Fr. Afr. Noir* 16 : 316. 1954.

Eriocaulon alleizettei MOLDENKE.

Additional literature : MOLDENKE, *Phytologia* 4 : 177-178 & 339. 1953; HAUMAN, Assoc. Etud. Tax. Fl. Afr. Trop. Index n.p. 1954; MOLDENKE in HUMBERT, Fl. Madag. 36 : 11-12, pl. 1, figs. 29-31. 1955.

Eriocaulon alpestre HOOK. F. & THOMS.

Additional literature : MOLDENKE, Known Geogr. Distrib. Eriocaul. 23, 25, 26, & 32. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 126, 132-134, 136, 141, & 203. 1949; MOLDENKE, *Phytologia* 3 : 181 (1949) and 4 : 339. 1953.

Smitinand reports that the species is common in damp localities at altitudes of 1300 meters, blooming in September, with blackish heads.

Additional citations : THAILAND : *Smitinand 1934a* [Herb. Roy. Forest Dept. 12169] (Z).

Eriocaulon amboënse SCHINZ.

Additional literature : MOLDENKE, Known Geogr. Distribu. Eriocaul. 22 & 32. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 121 & 203. 1949; HESS, *Bericht. Schweiz. Bot. Gesell.* 65 : 160, fig. 1, and 176-178, pl. 9, fig. 3. 1955.

Hess cites the type collection, *Schinz 859,* from Amboland, Southwest Africa, and his own *52/1719* and *52/1836a,* and *Baum 111* from Huila, Angola. The latter is a mixture with *E. heudelotii* N. E. Br. and was misidentified as *E. sexangulare* L. The species has been found at the edges of small pools, in sandy-limey soil which is inundated in the flowering season, in association with *E. gilgianum* Ruhl., *Eleocharis onthitensis* Hess, *Eleocharis antunesii* Hess, *Isoëtes welwitschii* A. Br., a species of *Cyperus,* and several lythraceous plants. Baum found it in damp sand.

According to Hess, the species is closely related to *E. heudelotii,* but in the latter species the leaves are abruptly attenuate to a filiform apex, instead of gradually attenuate as in *E. amboënse,* and the heads are white to yellow throughout, instead of black. He states that in *E. amboënse* pistillate florets with 2 and 3 sepals are sometimes found in the same head.

Eriocaulon angustisepalum Hess.

Literature : Hess, *Bericht. Schweiz. Bot. Gesell.* 65 : 160, figs. 7 & 8, and 170-173, pl. 9, figs. 6 & 7. 1955.

The species is based by Hess on his *52/2004,* collected in roadside ditches 45 km south of Cassinga, Guanhama, in Huila, Angola, on June 17, 1952. He cites in addition his *52/1754, 52/1755b, 52/1773b, 52/1994,* and *Antunes 168b,* all from Huila, Angola. His no. *52/1755b* was a mixture with *E. mutatum* N. E. Br. and *E. gilgianum* Ruhl., while *Antunes 168b* was a mixture with the type of *E. gilgianum.* The species grows only on sand, especially if covered by gently rippling water or slowly flowing water 1-4 cm deep, associated with *E. mutatum,* x*E. hessii* Moldenke, *E. gilgianum, E. welwitschii* Rendle, *E. buchananii* Ruhl., *E. aristatum* Hess, *Eleocharis nigrescens* (Nees) Steud., *Eleocharis spongostyla* Hess, and various other species of sedges, bladderworts, and loosestrifes, at altitudes of from 1180 to 1950 meters. It is closely related to *E. mutatum,* in which the sepals of the pistillate florets enclose the entire ripe fruit and are broadly alate and toothed on the dorsal keel, while in *E. angustisepalum* the sepals are very narrow, enclose only the edges of the fruit, and are not or only very narrowly alate on the keel. The two species hybridize readily (= x*E. hessii*).

Eriocaulon apiculatum H. Lecomte & Moldenke.

Additional literature : Moldenke, *Phytologia* 3 : 410-411 (1951) and 4 : 340. 1953; Moldenke in Humbert, Fl. Madag. 36 : 24-25, pl. 2, figs 2-4. 1955.

The species inhabits submerged rocks or often inundated rocks and cascades in streambeds.

Eriocaulon arechavaletae Herter.

Additional literature : Moldenke, Known Geogr. Distrib. Eriocaul. 20, 32, 36, & 62. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 100 & 203. 1949; Moldenke, *Phytologia* 3 : 182 (1949), 3 : 321 (1950), and 4 : 340. 1953; Herter, *Rev. Sudam. Bot.* 9 : 187-188. 1954.

Additional synonymy : *Eriocaulon arechavaletae* Moldenke, Known Geogr. Distrib. Eriocaul. 62. 1946.

Eriocaulon arenicola Britton & Small.

Additional literature : Moldenke, N. Am. Fl. 19 : 18 & 21. 1937; Moldenke, *Phytologia* 1 : 311. 1939; Moldenke, Known Geogr. Distrib. Eriocaul. 4 & 32. 1946; Léon, Fl. Cuba 280. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 45 & 203. 1949; Moldenke, *Phytologia* 3 : 182 (1949), 3 : 385 (1950), and 4 : 340. 1953.

Killip has collected this species in white sand savannas, blooming in January, and also in damp black soil, blooming in February. The Carabia collection cited below was misidentified by me as *E. sclerocephalum* Ruhl. in *Phytologia* 3 : 385 (1950).

Additional citations : Isla de Pinos : *Carabia 1152* (N); *Killip 42715* (Le), *42743* (Le, N), *45391* (Z), *45582* (Z).

Eriocaulon aristatum Hess.

Literature : Hess, *Bericht. Schweiz. Bot. Gesell.* 65 : 160, figs. 11 & 12, and 163-164, pl. 9, fig. 5 (1955) and 271. 1956.

The species is based on *Hess 52/1755a,* collected on a slope adjacent to Rio Nene, at an altitude of 1850 meters, 800 meters east of Humpata, Serra da Chela, Humpata district, in Huila, Angola, on May 15, 1952. Hess cites also his *52/2007* from the same province and *Dinter 7220* from Southwest Africa. The species grows on almost pure quartz sand which is thoroughly wet by

flowing water, in association with *E. mutatum* N. E. Br., *E. angustisepalum* Hess, *E. buchananii* Ruhl., and *Eleocharis nigrescens* (Nees) Steud. It is closely related to *E. gilgianum* Ruhl., in which, however, the sepals and bracts are pointed but not aristate as they are in *E. aristatum*. *E. welwitschii* Rendle differs in having only scattered-pilose receptacles (not densely long-pilose as in *E. aristatum*) and ciliate sepals, while *E. abyssinicum* Hochst. differs in having completely glabrous receptacles.

Eriocaulon atabapense Moldenke.

Additional literature : Moldenke, Known Geogr. Distrib. Eriocaul. 5 & 32. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 63 & 203. 1949; Moldenke, *Phytologia* 3 : 182 (1949) and 4 : 340. 1953; Moldenke in Maguire, *Mem. N. Y. Bot. Gard.* 8 : 97. 1953.

Eriocaulon atroides Satake.

Literature : Satake in Nakai, Icon. Pl. As. Orient. 2 (4) : 175, pl. 65. 1938; Honda, Nom. Pl. Jap. 461. 1939; Satake in Nakai, Nov. Fl. Jap. 6 : 71, fig. 39. 1940; Satake, Rev. Jap. Erioc. 59-60, pl. 12, fig. 23. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 134 & 203. 1949.

The species is based on *Y. Satake s.n.*, collected on Mount Takaharayama, Simotuke province, Honshiu, Japan, in September of 1933, and is deposited in the herbarium of Tokyo University. Satake also cites *Maekawa 6779* and *Kato 83032h* from the same island, where the species is said to be endemic. He records the vernacular name « kuroinunohige-modoki ». Koyama, however, in a note appended to the specimen cited below, says « This taxon is strikingly resembling to *E. atrum* Nakai from which this was first distinguished by its longer involucral scales always exceeding the disk flowers, and the puberulent apices of floral bracts and calyx. I consider this may be an extreme form of *E. atrum* Nakai because it has very wide deviation. »

Additional citations : Japan : Honshiu : *Furuse 14798* (Z).

Eriocaulon atroides f. **nanum** Satake.

Literature : Satake in Nakai & Honda, Nov. Fl. Jap. 6 : 73. 1940; Satake, Rev. Jap. Eriocaul. 60. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 134 & 203. 1949.

This form differs from the typical form of the species in being dwarf, in having the sepals of the pistillate florets not dark-olivaceous, and in having the involucral bractlets slightly longer than the florets.

Satake cites *Koidzumi 93495* and *93501h*, both from Ozegahara, Kozuke province, Honshiu, Japan, and records the vernacular name « oze-inunohige ».

Eriocaulon atrum Nakai.

Literature : Nakai in Fedde, *Repert.* 9 : 466. 1911; Mak. & Nemoto, Fl. Jap., ed. 1, 1304 (1925) and ed. 2, 1510. 1931; Miyabe & Kudo, Fl. Hokkaido & Saghal 3 : 288. 1932; Nemoto, Suppl. Fl. Jap. 1038. 1936; Honda, Nom. Pl. Jap. 461. 1939; Satake in Nakai & Honda, Nov. Fl. Jap. 6 : 76, fig. 38. 1940; Satake, Rev. Jap. Erioc. 60-61, fig. 24. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 133-134 & 203. 1949; Moldenke, *Phytologia* 3 : 182. 1949.

The species is said to be abundant in marshy places about small ponds, flowering in September. Satake cites the following collections — from Hokkaido : *Tokubuti a;* from Honshiu : *Collector undesignated 34228, Hasimoto 760, Hattori 2, Hayata 17067, Hosi 14, Hunabasi s.n., Itô 29745, Koidzumi 5602, Morimoto s.n., Murai 144, Satow s.n., Simizu 465, Suzuki 43161, Ui 21,* and *Yosino 34325* and *s.n.;* from Shikoku : *Yogo 6;* from Kiushiu : *Doi 58* and *60, Kitano 51, Nakasima 48, Sugino 1929,* and *Tasiro 29999* and *s.n.;* and from Tyôsen : *Saito 1780.* The type of the species is *Kodama s.n.,* collected at Akanumahara, Nikkô, Simotuke province, Honshiu, Japan, in August of 1910 and is deposited in the herbarium of Tokyo University. A vernacular name is « kuro-inunohige ».

Additional citations : Japan : Honshiu : *Furuse s.n.* [16 September 1954] (Z), *s.n.* [17 Sept. 1954] (Z); *Sato 12001* (Z).

Eriocaulon atrum var. **intermedium** Nakai.

Literature : Satake, *Journ. Jap. Bot.* 15 : 142. 1939; Satake in Nakai & Honda, Nov. Fl. Jap. 6 : 74. 1940; Satake, Rev. Jap. Eriocaul. 61-62. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 134 & 203. 1949.

The variety differs from the typical form of the species in its many-flowered heads and in the involucral bractlets being numerous,

ovate-lanceolate, not blackish at the apex, and about equaling the florets in length.

The type of the variety is *Z. Yosino 30,* collected at Keyaki, Bittyû province, Honshiu, Japan. A common name is « saikoku-kuroinunohige ». Satake cites also the following collections — from Honshiu : *Collector undesignated 21, Matusima 37353, Moriya s.n., Nakasima s.n.,* and *Ui 21* and *s.n.;* from Kiushiu : *Creatrex 44/39, Doi 50, Nakasima 18881, Oto 2, Takano 352,* and two unnumbered Tasiro collections.

Eriocaulon atrum var. **platypetalum** Satake.

Literature : Satake, *Journ. Jap. Bot.* 15 : 632. 1939; Satake in Nakai & Honda, Nov. Fl. Jap. 6 : 75, fig. 39. 1940; Satake, Rev. Jap. Eriocaul. 62-63. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 134 & 203. 1949.

The variety differs from the typical form of the species in its glabrous floral bractlets, the sepals having glabrous margins, and the petals of the pistillate florets being broader.

The type of the variety is *E. Taquet 6189,* collected on Saisyû-yô island, Tyôsen, Japan, in September of 1912, and is deposited in the herbarium of Tokyo University. A vernacular name recorded for it is « tanna-koroinunohige ». It is known only from the original collection.

Eriocaulon australe R. Br.

Additional literature : R. Br., Prodr. Fl. Nov. Holl. 1 : 254. 1810; Kunth, Enum. Pl. 3 : 569. 1841; Moldenke, Known Geogr. Distrib. Eriocaul. 25, 27, & 32. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 132, 153, 155, & 203. 1949; Moldenke, *Phytologia* 3 : 182-183 (1949) and 4 : 340-341. 1953.

Eriocaulon baurii N. E. Br.

Additional literature : Moldenke, Known Geogr. Distrib. Eriocaul. 22 & 32. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 122 & 203. 1949.

Additional citations : Union of South Africa : Natal : *Schweickerdt 1313* (N).

Eriocaulon benthami KUNTH.

Additional literature : MORONG, *Bull. Torrey Bot. Club* 18 : 357. 1891; MOLDENKE, N. Am. Fl. 19 : 19 & 32. 1937; MOLDENKE, *Phytologia* 1 : 311. 1939; MOLDENKE, Known Geogr. Distrib. Eriocaul. 3 & 32. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 30 & 203. 1949; MOLDENKE, *Phytologia* 3 : 183 (1949) and 4 : 341. 1953.

Eriocaulon bifistulosum VAN HEURCK & MÜELL.-ARG.

Additional literature : VAN HEURCK, Observ. Bot. 105. 1870; J. G. BAKER, *Journ. Linn. Soc. Lond. Bot.* 20 : 227. 1893; DURAND & SCHINZ, Conspect. Fl. Afr. 5 : 502. 1895; RUHL. in ENGL., *Bot. Jahrb.* 27 : 74-75. 1899; N. E. BR. in THISELT.-DYER, Fl. Trop. Afr. 8 : 239-240. 1901; RUHL. in ENGL., Pflanzenreich 13 (4-30) : 90. 1903; MOLDENKE, Known Geogr. Distrib. Eriocaul. 20-23, 32, & 34. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 109, 111, 112, 114, 118, 119, 123, 126, 153, 203, & 204. 1949; MOLDENKE, *Phytologia* 3 : 183 (1949) and 3 : 321. 1950; WILD, *Rhodesia Agric. Journ.* 49 : 12-13, fig. 10. 1952; MOLDENKE, *Phytologia* 4 : 341. 1953; HESS, *Bericht. Schweiz. Bot. Gesell.* 65 : 127, fig. 3, and 130-133, pl. 7, figs. 3-5. 1955; MOLDENKE in HUMBERT, Fl. Madag. 36 : 5-7, pl. 1, figs 1-8. 1955.

Hess, in the reference cited above, cites his nos. *52/1678* and *52/1832* from Huila, Angola, where he found the species at an altitude of 1830-1850 meters, blooming in May, growing abundantly in seasonal lakes in water 30-60 cm deep, in association with *Eleocharis pseudofistulosa* HESS, *Anagallis kochii* HESS, and species of *Lagarosiphon, Limnanthemum, Naias,* bladderworts, and loosestrifes. The soil beneath the water was muddy-sandy-humus.

This species greatly resembles *E. setaceum* L., *E. melanocephalum* KUNTH, and *E. submersum* WELW. in habit. The first of these differs in its long-pilose sepals and petals; the second in having the petals of the staminate florets glanduliferous; and the third with more uniformly broader leaves, the fruiting-heads 6-8 mm (instead of 4-5 mm) wide, and entirely different floral characters as described in detail by Hess. It also greatly resembles *E. lacustre* RUHL. and *E. schippii* STANDL. The first of these has the sepals of the pistillate florets ovate (not obovate) and the petals linear (not spathulate), while the second has the receptacular bractlets tufted-pilose (not glabrous) at the apex.

Eriocaulon bilobatum Morong.

Additional literature : Morong, *Bull. Torrey Bot. Club* 19 : 226. 1892; Moldenke, N. Am. Fl. 19 : 18 & 20. 1937; Moldenke, *Phytologia* 1 : 311-312. 1939; Moldenke, Known Geogr. Distrib. Eriocaul. 4 & 32. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed .2]), 30, 35, & 204. 1949; Moldenke, *Phytologia* 3 : 183-184. 1949.

Additional citations : Mexico : Jalisco : *Pringle 3855* (Br-isotype).

Eriocaulon brevifolium var. **proliferum** Moldenke.

Citations : Venezuela : Amazonas : *Maguire & Wurdack 34595* (N-type).

Eriocaulon brevipedunculatum Merr.

Additional literature : E. D. Merr., *Philipp. Journ. Sci. Bot.* 2 : 265. 1907; Moldenke, Known Geogr. Distrib. Eriocaul. 26. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 141, 145, & 204. 1949; Moldenke, *Phytologia* 3 : 322. 1950; Heine in Fedde, *Repert.* 54 : 224. 1951.

Brass reports that he found this species very abundant and sometimes completely covering boggy ground at an altitude of 3225 meters, flowering in August. He and Meyer-Drees found it in large cushions on marshy slopes of alpine grassland, at an altitude of 3560 meters, flowering in September. A note accompanying their specimen states that it is not matched at Kew except for a specimen collected by A. Giulianetti in 1896 at 12,000 feet altitude on Mount Scratchlet, New Guinea. The Clemenses found it in boggy meadows, open alpine places, in the shelter of boulders, and in wet ground at pools, forming mats, at altitudes of 7000 to 13,000 feet, with gray inflorescences, flowering in January, May, June, and November. The type collection is *Merrill 6214* from 2400 meters altitude on Mount Halcon, Mindoro, Philippine Islands.

Additional citations : British North Borneo : *Clemens & Clemens 27089* (N), *27777* (N), *30059* (N), *32336* (N).

New Guinea : Dutch New Guinea : *Brass 9226* (N); *Brass & Meyer-Drees 9956* (N). Northeastern New Guinea : *M. S. Clemens 5584* (N), *7409* (N), *9368* (N), *9942* (N).

Eriocaulon brevipendunculatum var. **angustifolium** Moldenke.

Literature : Moldenke, *Phytologia* 4 : 127-128. 1952.

The variety differs from the typical form of the species in having its leaves much narrower, usually only 0.5-1.5 mm wide.

It has been collected in bogs and pools, where it is described as being « amphibious », on submerged cushions in *Sphagnum*-filled pools, forming cushions in open sunny bogs, and massed in alpine bog turf, at altitudes of 3225 to 3560 meters, flowering in August and September, the inflorescence black. The Brass & Meyer-Drees collection is accompanied by a note indicating that the plant could not be matched in the Kew herbarium.

Citations : New Guinea : Dutch New Guinea : *Brass 9231* (N), *9282* (N), *9288* (N-type), *9318* (N); *Brass & Meyer-Drees 9997* (N).

Eriocaulon brownianum Mart.

Literature : Wall., Numer. List 207, no. 6066. 1832; Wall., Plant. As. Rar. 3 : 25-26, pl. 248. 1832; Kunth, Enum. Pl. 3 : 562. 1841; Steud., Syn. Pl. Cyp. 2 : 271. 1855; Körn., *Linnaea* 27 : 663. 1856; Thwait., Enum. Pl. Zeyl. 1 : 341. 1864; Hook. f., Fl. Brit. Ind. 6 : 576. 1894; Trimen, Handb. Fl. Ceylon 5 : 6. 1900; Ruhl. in Engl., Pflanzenreich 13 (4-30) : 84. 1903; Fyson, *Journ. Ind. Bot.* 2 : 262-264. 1921; Moldenke, Known Geogr. Distrib. Eriocaul. 23, 24, & 33. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 124, 126, 130, & 204. 1949; Moldenke, *Phytologia* 3 : 184. 1949; Razi, *Journ. Mysore Univ.* 11 : 7. 1950.

In spite of the statements of Fyson in the reference cited above, I feel that his *E. brownianum* var. *nilagirense* (Steud.) Fyson, as well as the *E. brownianum* Hook. f., should be transferred to synonymy under *E. nilagirense* Steud., and his *E. brownianum* var. *macrophyllum* (Ruhl.) Fyson should be maintened as *E. macrophyllum* Ruhl. Razi records *E. brownianum* from Mysore. It seems probable that the *De Silva 2* collection cited below is actually part of the same *Wallich 6066* material cited as *De Silva & Gomez s.n.* elsewhere. Wallich himself states that the type of the species was collected by « F. de Silva », but gives no collection number.

Additional citations : Pakistan : East Bengal : *Griffith 5574* (C).

India : Assam : *De Silva 2* [Wallich 6066] (Br-isotype, N-photo of isotype, Z-photo of isotype); *Hooker & Thomson s.n.* [Mont. Khasia, 3-5000 ped.] (Br). State undetermined : *Wight 2859* (T).

Indo-China : Laos : *Pételot 8070* (N).

Eriocaulon brownianum var. **latifolium** Moldenke.

Literature : Moldenke, *Phytologia* 3 : 411. 1951.

The variety differs from the typical form of the species in having its leaf-blades up to 1 cm wide at the mid-point.

Citations : Ceylon : *Thwaites C. P. 378* (Br-type, N-photo of type, Z-photo of type).

Eriocaulon brunonis Britten.

Literature : J. Sm. in Rees, Cyclop. 12 : 197. 1809; R. Br., Prod. Fl. Nov. Holl. 1 : 255. 1810; Beauv. & Desv., *Ann. Sci. Nat. Paris,* sér. 1, 13 : 47. 1828; Kunth, Enum. Pl. 3 : 571. 1841; Steud., Syn. Pl. Cyp. 2 : 269. 1855; Körn., *Linnaea* 27 : 587. 1856; Benth., Fl. Austral. 7 : 197. 1878; Jacks., Ind. Kew. 1 : 879. 1893; Britten, *Journ. Bot.* 38 : 482. 1900; Moldenke, Known Geogr. Distrib. Eriocaul. 27, 33, & 39. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 153 & 204. 1949.

Synonymy : *Eriocaulon scariosum* R. Br., Prodr. Fl. Nov. Holl. 1 : 255. 1810 [not *E. scariosum* J. Sm., 1809]. *Randalia scariosa* Beauv. & Desv., *Ann. Sci. Nat. Paris,* sér. 1, 13 : 47. 1828. *Eriocaulon brunonia* Britten ex Moldenke, Known Geogr. Distrib. Eriocaul. 39, sphalm. 1946.

Eriocaulon buchananii Ruhl.

Literature : Moldenke, Known Geogr. Distrib. Eriocaul. 21, 22, & 33. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 117, 119, 120, & 204. 1949; Moldenke, *Phytologia* 3 : 184. 1949; Hess, *Bericht. Schweiz. Bot. Gesell.* 65 : 138, figs. 5 & 6, and 145-147, pl. 8, figs. 7-9. 1955.

The type of this species is *J. Buchanan 1168* from Nyasaland, deposited in the herbarium of the Botanisches Museum at Berlin. Hess cites also *Whyte s.n.* from Tanganyika Territory and his own *52/1620, 52/2003, 52/2015, 52/2019,* and *52/2041* from Huila, Angola, and *52/2064* from Bié, Angola. The species has

been collected at altitudes of 1320 to 1820 meters in sandy-calcareous soil which is covered by 1-5 cm of water even at the fruiting period — this causes the leaves of the plant to be rotted away at that time. The species occurs in clumps on the almost bare ground around springs and also among grasses and sedges in swamps. In somewhat drier localities it grows in association with *E. gilgianum* Ruhl. and *E. abyssinicum* Hochst. The species is very closely related to *E. andongense* Welw. and may even prove to be conspecific with it. According to N. E. Brown, however, *E. andongense* differs in having the sepals of its pistillate florets more sharply and attenuately pointed.

Additional citations : Southern Rhodesia : *C. K. Brown 4033* (N).

Eriocaulon buergerianum Körn.

Additional literature : Körn. in Miq., *Ann. Mus. Bot. Lugd.-Bat.* 3 : 163. 1867; Franch. & Savat., Enum. Pl. Jap. 2 : 100. 1879; Mak., *Bot. Mag. Tokyo* 4 : 174. 1890; Maxim., Diagn. Pl. Nov. As. 8 : 20. 1892 ; Mak., *Bot. Mag. Tokyo* 8 : 506. 1894 ; C. H. Wright, *Journ. Linn. Soc. Lond. Bot.* 36 : 198. 1903; Ruhl. in Engl., Pflanzenreich 13 (4-30) : 94. 1903; Matsumura, Ind. Pl. Jap. 2 (1) : 175. 1905; Hayata, Icon. Pl. Formos. 10 : 52, fig. 29. 1921; Mak. & Nemoto, Fl. Jap., ed. 1, 1304 & 1307. 1925; Sasaki, List Pl. Formos. 99. 1928; Mak. & Nemoto, Fl. Jap., ed. 2, 1510 & 1513. 1931; Nemoto, Suppl. Fl. Jap. 1038-1039. 1936; Masamune, Short Fl. Formos. 262. 1936; Honda, Nom. Pl. Jap. 461. 1939; Satake in Nakai & Honda, Nov. Pl. Jap. 6 : 51, fig. 23. 1940; Satake, Rev. Jap. Erioc. 42-44. 1940; Moldenke, Known Geogr. Distrib. Eriocaul. 25 & 33. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 108, 132-135, 140, & 204. 1949; Moldenke, *Phytologia* 3 : 184. 1949.

Common names recorded for this species are « oo-hosikusa » and « tôen-inunohige ». It has been misidentified in herbaria as « *E. shikokianum* Maxim. » and « *E. suishaense* Hayata ». Satake cites the following collections — from Honshiu : *Hasimoto 43767, Inagaki 7431, Matusima 37355, Moriya s.n., Nakazima s.n.* [1925] and *s.n.* [1928], *Nikai 941, Sakaguti 16, 18,* and *21, Tasiro s.n., Tuboi s.n., Tutumi s.n.,* and *Ui 20* and *72;* from Shikoku : *Makina s.n., Oti 7, Watanabe s.n., Yamamoto s.n.* [1913] *and s.n.* [1928], and *Yamasita s.n.;* from Kiushiu : *Doi 55* and *62, Creatrex 45/39,*

Hunabasi s.n., Mayebara 359, Nagano s.n., Nakasima 45, Sugino s.n., Taniguti s.n., Tasiro 28775 in part. *33346, 43768* in part. *60088, s.n.* [1909], *s.n.* [Sept. 1921], and *s.n.* [Oct. 1921], *Yamasita 43769,* and *Yamazaki s.n.;* from Okinawa : *Itô 1148, Koidzumi s.n.,* and *Taira s.n.;* and from Formosa : *Inoue s.n., Kawakami s.n., Shimada s.n.,* and *Suzuki 11764.*

Additional citations : Liukiu Islands : Okinawa : *Amano 6012* (N); *Walker, Sonohara, Tawada, & Amano 7120* (N); *Walker, Tawada, & Amano 6479* (N).

Eriocaulon burchellii Ruhl.

Additional literature : Moldenke, Known Geogr. Distrib. Eriocaul. 7 & 33. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 76 & 204. 1949; Moldenke, *Phytologia* 3 : 184-185. 1949.

Additional citations : Brazil : Goyaz : *Burchell 7812* [Macbride photos 10556] (Br-isotype, N-photo of type, T-isotype).

Eriocaulon caaguazuense Ruhl.

Additional literature : Ruhl. in Engl., *Bot. Jahrb.* 37 : 519. 1906; Prain, Ind. Kew. Suppl. 4 : 82. 1913; Moldenke, Known Geogr. Distrib. Eriocaul. 19. 1946; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 98 & 204. 1949.

Synonymy : *Eriocaulon caaguazensis* Ruhl. in Engl., *Bot. Jahrb.* 37 : 519, sphalm. 1906.

The species is based on *Hassler 8885,* collected in the vicinity of Caaguazú, Paraguay, in February of 1905. The species has been collected in anthesis in February and September, and has been confused in herbaria with *E. sellowianum* Kunth.

Additional citations : Paraguay : *Hassler 8885* (N-isotype, N-photo of isotype, S-isotype, Z-photo of isotype), *9425* (N).

Eriocaulon candidum Moldenke.

Additional citations : Brazil : Rio Grande do Sul : *A. R. Schultz 700* (N-type), *774* (N).

Eriocaulon cauliferum Mak.

Literature : Mak., *Bot. Mag. Tokyo* 24; 165. 1910 ; Mak. & Nemoto, Fl. Jap., ed. 1, 1304 (1925) and ed. 2, 1510. 1931 ;

NEMOTO, Suppl. Fl. Jap 1038. 1936; HONDA, Nom. Pl. Jap. 462. 1939; SATAKE in NAKAI & HONDA, Nov. Fl. Jap. 6 : 27, fig. 10. 1940; SATAKE, Rev. Jap. Eriocaul. 17-19. 1940; MOLDENKE, Known Geogr. Distrib. Eriocaul. 25. 1946; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 134 & 204. 1949.

Satake cites *Hisauti s.n., Ogata s.n., Sekimoto s.n., Siobara 40338,* and *Takano s.n.,* all from Honshiu, Japan, where the species is endemic. He points out that the species is well characterized by its elongate stems, with the peduncles fasciculate at their apices, and its linear 1-veined leaves which are densely spiral on the stems. A vernacular name is « takano-hosikusa ». It is related to *E. parvum* KÖRN., but differs in its smaller heads and glabrous receptacles.

Eriocaulon ceylanicum KÖRN.

Literature : FYSON, *Journ. Ind. Bot.* 2 : 310. 1921; MOLDENKE, Known Geogr. Distrib. Verbenac., [ed. 2], 130 & 204. 1949.

Synonymy : *Eriocaulon ceylanicum* var. *typica* FYSON, *Journ. Ind. Bot.* 2 : 310. 1921.

This species is closely related to *E. atratum* KÖRN., which has the lower floral bractlets short-cuspidate and the upper acute. The *Kuntze 20046* cited by me in 1949 as *E. ceylanicum* is actually *E. atratum.* I am following Ruhland in regarding *E. subcaulescens* HOOK. F. as a distinct species, not as a variety of *E. ceylanicum* as claimed by Fyson. It differs in having a stem up to 2 inches long, shorter and broader leaves, and stouter scape. Fyson feels that it is only a more developed state or a form of drier localities. .

Additional citations : CEYLON : *G. Gardner 934* (Br, N, N-photo, Z-photo).

Eriocaulon ciliipetalum HESS.

Literature : HESS, *Bericht. Schweiz. Bot. Gesell.* 65 : 263-265, figs. 1-3. 1955.

The species is based on *Schlieben 2674* from Ngombeni, Mafia Island, collected July 12, 1932, in open marshy spots in bushland, where it occurs singly or in groups. It is known only from the original collection and is closely related to *E. ruhlandii* SCHINZ and cannot be distinguished from it on foliar characters. In *E. ruhlandii,* however, the scapes are up to 10 cm tall and twisted, the sheaths are usually fimbriate on the margins and not as attenuate at the

apex, the heads are grayish-black, the involucral bractlets are 1.8-2.2 mm long and 0.8-1 mm wide, obovate, often fimbriate at the margins, gray, the receptacular bractlets are 1.5-2 mm long and 0.7 mm wide, and the receptacle is less densely pilose. In *E. ciliipetalum* the scapes are 2-5 cm tall, not twisted, the sheaths are attenuate at the apex and not fimbriate, the heads are pale-yellow or almost white, the involucral bractlets are obovate or lanceolate, 2.3-3 mm long and 0.7-1.4 mm wide, pale-yellow, and not fimbriate, the receptacular bractlets are 2.1-2.4 mm long and 0.7-1 mm wide, and the receptacles are densely pilose.

Eriocaulon cinereum R. Br.

Additional literature : Wall., Plant. As. Rar. 3 : 28. 1832; Kunth, Enum. Pl. 3 : 571. 1841; Steud., Syn. Pl. Cyp. 2 : 272. 1855; Körn., *Linnaea* 27 : 613. 1856; Benth., Fl. Hongkong 382. 1861; Miq., *Ann. Mus. Bot. Lugd.-Bat.* 3 : 162. 1867; Franch. & Savat., Enum. Pl. Jap. 2 : 99. 1879; Maxim., Diagn. Pl. Nov. As. 8 : 10 & 12. 1892; Hook., Ind. Kew. 1 : 879. 1893; Mak., *Bot. Mag. Tokyo* 8 : 506. 1894; Hook. f., Fl. Brit. Ind. 6 : 577. 1896; Trimen, Handb. Fl. Ceylon 5 : 10. 1900; Ruhl. in Engl., Pflanzenreich 13 (3-30) : 111, fig. 112. 1903; C. H. Wright, *Journ. Linn. Soc. Lond. Bot.* 36 : 200. 1903; Matsumura, Ind. Pl. Jap. 2 (1) : 176-177. 1905; Matsumura & Hayata, Enum. Pl. Formos. 467. 1906; Nakai, Fl. Koreana 2 : 282. 1911; E. D. Merr., Fl. Manila 136. 1912; Mak. in Iinuma, Sômoku-Dzusetsu 4 : 1159, pl. 1035. 1913; E. D. Merr., *Philipp. Journ. Sci. Bot.* 10 : 291. 1915; Hayata, Gen. Ind. Fl. Formos. 87. 1917; Fyson, *Journ. Ind. Bot.* 1 : 52, figs. 10 & 11. 1919; Hayata, Icon. Pl. Formos. 10 : 49, fig. 27. 1921; E. D. Merr., Enum. Philipp. Flow. Pl. 1 : 192. 1922; Mori, Enum. Pl. Corea 80. 1922; Lecomte, Fl. Gén. Indochine 7 : 13. 1922; Mak. & Nemoto, Fl. Jap., ed. 1, 1304 & 1307. 1925; Sasaki, List Pl. Formos. 99. 1928; Mak. & Nemoto, Fl. Jap., ed. 2, 1511 & 1514. 1931; Steinberg, Fl. U.R.S.S. 3 : 495, pl. 28, fig. 3. 1935; Nemoto, Suppl. Fl. Jap. 1038 & 1040. 1936; Masamune, Short Fl. Formos. 262. 1936 ; Honda, Nom. Pl. Jap. 463. 1939; Satake in Nakai & Honda, Nov. Fl. Jap. 6 : 20, fig. 8. 1940; Satake, Rev. Jap. Erioc. 11-14. 1940; Moldenke, Known Geogr. Distrib. Eriocaul. 23-27, 33, 35 & 40. 1946; Razi, *Journ. Mysore Univ.* 7 (4) : 66. 1946; Moldenke, *Phytologia* 3 : 185. 1949; Govindu, *Journ. Mysore Univ.* 10 (1) : 4. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 27,

117, 124, 126, 129, 130, 132-136, 140, 141, 143, 144, 152, 153 & 204. 1949; THIRUMALACHAR, RAZI & SWAMY, *Journ. Mysore Univ.* 9 (5) : 82. 1949; MOLDENKE, *Phytologia* 3 : 322. 1950; RAZI, *Journ. Mysore Univ.* 11 (1) : 6 & 16. 1950; MOLDENKE, *Phytologia* 3 : 468. 1951.

Synonymy : *Eriocaulon sieboldtianum* SIEB. & ZUCC. ex STEUD., Syn. Pl. Cyp. 2 : 272. 1855. *Eriocaulon heteranthum* BENTH., Fl. Hongkong 382. 1861. *Eriocaulon formosanum* HAYATA, Icon. Pl. Formos. 10 : 49, fig. 27. 1921. *Eriocaulon cinereum* MERR. apud SATAKE, Rev. Jap. Eriocaul. 11, in syn. 1940. *Eriocaulon sexangulare* MART. apud SATAKE, Rev. Jap. Eriocaul. 11, in syn 1940 [not *E. sexangulare* L., 1753]. *Eriocaulon nitidum* BUCH.-HAM. ex WALL., Numer. List 207, no. 6073. 1832 [not *E. nitidum* BONG., 1831]. *Eriocaulon tenue* BUCH.-HAM. ex WALL., Numer. List 207, no. 6073. 1832 [not *E. tenue* H. B. K., 1816, nor POEPP., 1863]. *Eriocaulon sieboldianum* SIEB. & ZUCC. ex HOOK., Ind. Kew. 1 : 879. 1893. *Eriocaulon hexangulare* WALL., in herb. [not *E. hexangulare* ROYLE, 1839].

Specimens of this widespread species have been misidentified in herbaria as *E. buergerianum* KÖRN., *E. setaceum* L., and *E. sexangulare* L. The correct name for the taxon is in much confusion. Ruhland and Lecomte both regard Brown's *E. cinereum* and Siebold & Zuccarini's *E. sieboldtianum* as conspecific, but for some unaccountable reason, adopt the latter name as the valid one for the species, even though Brown's name was published 45 years earlier ! Merrill noted this fact and adopted Brown's name for the species and in this I follow him, but Satake seems to feel that Brown's plant and that of Siebold & Zuccarini are not conspecific. Yet he fails to give any supposed differences between them. I am continuing to regard them as the same taxon until someone can point out to me any specific differences. *E. cinereum* is a very widespread and very variable species. It has been collected in anthesis in January, February, August, September, and November, at altitudes of from 100 to almost 2000 meters. Smitinand describes the flowers as « greenish ». Thirmumalachar, Razi & Swamy describe it as « Marshy plants with short stems, with capillary or very narrowly linear leaves, plants and involucral bracts glabrous, bracts hyaline, shiny, often with purplish central zone. » Razi records it from Mysore and Govindu from Bangalore. It has been collected about the edges of small pools in savanna forests, in 2 inches of water in

rice paddies, in wet sandy-clayey soil with *Juncus* and *Polygonum* species, common on sandy banks of streams, and forming very large pure-stand colonies in wet sand at the edge of small pools. The *Blume s.n.* cited by me in 1949 as this species proves actually to be *E. thwaitesii* Körn.

Satake cites the following specimens — from Honshiu : *Collector undesignated 6, 3601, 14500, 17149, 32722,* and *s.n., Faurie 1867* and *13785, Hasimoto s.n., Hayata 17069, Imai 16* and *43770, Itô s.n., Iwabuti 5364, Kinashi 90, Koidzumi 10557* and *10685, Nakahara 24714, Nakazima s.n., Nikai 798, 49458,* and *49460, Ogita 37356, Ohwi & Tagawa s.n., Otaya s.n., Satake s.n., Shirai 54434, Tamaki s.n., Ui 71, Yamada 11440,* and 3 unnumbered collections of Matsumura; from Shikoku : *Collector undesigned 32726, Murai 8, Oti 4, 5,* and 6, and *Yamasita s.n.;* from Kiushiu : *Ikebe s.n.; Koidzumi s.n., Masamune s.n., Nakasima 34, 35,* and *36, Nozute 66, Ohba 220* and *s.n., Takeuti 28237, Yamasita s.n., Yamazaki s.n.,* and 2 unnumbered collections of Tasiro; from the Liukiu Islands : *Kanasiro 713, Koidzumi s.n., Sakaguti s.n., Simada s.n., Taira s.n., Takamine 72,* and *Tomoyori s.n.;* from Tyôsen : *Faurie 894* and *1433, Mori 58, Nakai 2999* and *6119, R. K. Smith 2, Taquet 17, Ueki 433,* and *Utiyama s.n.;* and from Formosa : *Itô 84607* and *84608, Kawakami & Sasaki s.n., Makino s.n., Nakahara 612, Yamamoto & Mori s.n.,* and 2 unnumbered collections of Simada.

Additional citations : Nepal : *A. B. Lambert s.n.* [Nepal] (Br).

India : Assam : *H. Bruce 17* (Br). Bihar : *Hamilton s.n.* [Manikapur] (Br). Bombay : *Stocks, Law, etc. s.n.* [Malabar, Concan] (Br). Madras : *Wallich 6077*b (Br). United Provinces : *Strachey & Winterbottom 3* (Br).

Burma : Tenasserim : *Gomez 21* (Br).

Ceylon : *Thwaites 795* (Br).

China : Kwangtung : *E. D. Merrill 10948* (Ug).

Japan : Honshiu : *Koyama 13106* (Z); *Maximowicz s.n.* [Yokohama, 1862] (Br); *Mihashi 96* (Z); *Utsumi 239* (Z); *Uyezuki s.n.* [Sept. 4, 1914] (Kg). Island undetermined : *Göring 23* (E); *Kawagoe s.n.* [Satsuma Prov., Nov. 5, 1921] (Kg).

Indo-China : Annam : *Schmid* 1413 (N), *1417* (Z). Tonkin : *Petelot 8074* (N).

Thailand : *Smitinand* 2163 [Herb. Roy. Forest Dept. 12091] (Z).

Liukiu Islands : Okinawa : *Amano 7024* (Kg, W-2092388); *Conover 1003* (W-1993137); *Elliott & Nakamine 628* (Z); *Walker, Sonohara, Tawada, & Amano 6148* (N). Takarajima : *Hurukawa 512* (Kg). Tokunoshima : *Hosoyamada s.n.* [Aug. 14, 1927] (Kg). Yoronjima : *Uyehara s.n.* [Sept. 14, 1920] (Kg).

New Guinea : Papua : *Brass 6535* (N).

Australia : Queensland : *Storr 13146* (Qu).

Locality of collection undetermined : *Herb. Hamilton s.n.* [Botanical Garden, 10 Jan. 1815] (Br); *Herb. Heyne* s.n. (Br).

Eriocaulon collettii Hook. f.

Additional literature : Hook. f., Fl. Brit. Ind. 6 : 575. 1894; Ruhl. in Engl., Pflanzenreich 13 (4-30) : 114. 1903; Fyson, *Journ. Ind. Bot.* 2 : 196-197, pl. 3. 1921; Moldenke, Known Geogr. Distrib. Eriocaul. 24 & 33. 1946; Moldenke, *Phytologia* 3 : 186. 1949 ; Moldenke, Known Geogr. Distrib. Verbenac., [ed 2], 129 & 204. 1949.

Fyson states that Hooker was in error in claiming that the petals of the staminate florets are longer than the others and protrude beyond the bracts, and that they are actually « quite equal ».

Eriocaulon collinum Hook. f.

Additional literature : Hook. f., Fl. Brit. Ind. 6 : 584. 1894 ; Fyson, *Journ. Ind. Bot.* 2 : 139, fig. 3, 150, 206, 207, & 260, pl. 15. 1921; Moldenke, Known Geogr. Distrib. Eriocaul. 23, 24, & 33. 1946; Razi, *Journ. Mysore Univ.* 7 (4) : 77. 1946; Moldenke, *Phytologia* 3 : 186. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 126, 130, & 204. 1949; Moldenke, *Phytologia* 3 : 322. 1950.

Synonymy : *Eriocaulon dianae* var. *triloboides* Fyson, *Journ. Ind. Bot.* 2 : 260. 1921. *Eriocaulon luzulifolium* f. *nigrescens* Ruhl., in herb.

This species has been misidentified in herbaria as *E. trilobum* Buch.-Ham.

Additional citations : India : Madras : *C. McCann 50181* (N, Xa).

Ceylon : *G. Gardner 935* (Br, N); *Thwaites 796* (Br).

Eriocaulon compressum Lam.

Additional literature Walt., Fl. Carol. 83. 1788; Lam., Encycl. Méth. Bot. 3 : 276. 1789; Michx., Fl. Bor. Am. 2 : 165. 1803; Poir. in Lam., Encycl. Suppl. 3 : 161. 1813; Spreng., Syst. Veg. 3 : 755. 1826; Desv., *Ann. Sci. Nat. Paris*, sér. 1, 13 : 47, pl. 5, fig. 1, 1828; Bong., *Act. Petrop. Sci. Math.*, sér. 4, 1 : 634. 1831; Raf., Atl. Journ. 121. 1832; Kunth, Enum. Pl. 3 : 497, 542, & 575. 1841 ; Körn., *Linnaea* 27 : 592. 1854; Morong, *Bull. Torrey Bot. Club* 18 : 354. 1891; Coulter, *Contrib. U. S. Nat. Herb.* 2 : 459. 1894 ; Britton & Br., Illustr. Fl., ed. 1, 1 : 372, fig. 900. 1896; Small, Fl. Southeast. U. S., ed 1, 236 (1903) and ed. 2, 236. 1913; Britton & Br., Illustr. Fl., ed. 2, 1 : 454, fig. 1142. 1913; Cory, *Texas Agr. Exp. Sta. Bull.* 550 : 29. 1937; Moldenke, N. Am. Fl. 19 : 22. 1937; Moldenke, *Phytologia* 1 : 312-313. 1939; Moldenke in Lundell, Fl. Texas 3 (1) : 5-6. 1942; Moldenke, Known Geogr. Distrib. Eriocaul. 1-3 & 33. 1946; Moldenke, *Phytologia* 2 : 153 (1948) and 3 : 186-189. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 4-11, 18, 22, & 204. 1949; Thorne, *Am. Midl. Nat.* 52 : 281. 1954.

Singletary records the common name « pipewort » for this species. It has been collected in wet pinelands and cypress ponds in Georgia, and in the everglades in Florida. In Texas it is said to inhabit still shallow water of acid ponds, swamps, and low pinelands, and streams in the Timber Belt area. In 1942 I stated that no Texan specimens of this species had actually been seen by me to substantiate claims made by other authors that it grows in that state. However, in my 1949 publication (*Phytologia* 3 : 188-189) I cite six specimens from that state. *Reverchon 2766*, originally identified as this species in herbaria, is actually *E. decangulare* L., and *Reverchon 4359*, also originally identified as *E. compressum*, proves to be *E. texense* Körn. Similarly, the *Morong s.n.* [Aug. 11, 1873], so identified in the Barnard College herbarium, is actually *E. decangulare* L.

Additional citations : New Jersey : Ocean Co. : *Ahles 680/48* (Ur); *Barkley, Cohn, & Copeland 23NJ001* (Le).

North Carolina : New Hanover Co. : *E. Anderson s.n.* [May 1928] (E-957371); *Buell & Godfrey 3550* (No-2621). Wake Co. : *C. W. Hyams 817* (No-2622).

South Carolina : County undetermined : *M. A. Curtis s.n.* [S. C., 1848] (E).

Georgia : Calhoun Co. : *Thorne & Muenscher 8021* (N).

Florida : Clay Co. : *W. M. Canby s.n.* [Hibernia, March 1869] (Pr). Highlands Co. : *C. C. Deam 64257* (No-21315). Osceola Co. : *Singletary 47* (No-2632). Palm Beach Co. : *J. K. Small 8274* (N).

Mississippi : Jackson Co. : *Demaree 30672* (N). County undetermined : *Demaree 28664* (N).

Eriocaulon compressum var. **harperi** Moldenke.

Literature : Moldenke, N. Am. Fl. 19 : 23. 1937; Moldenke, *Phytologia* 1 : 313. 1939; Moldenke, Known Geogr. Distrib. Eriocaul. 2, 3, & 33. 1946; Moldenke, *Phytologia* 3 : 189. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 8-11, 18, & 204. 1949.

Additional citations : Mississippi : Jackson Co. : *Demaree 34717* (Z).

LES CENTAURÉES DE LA SOUS-SECTION *JACEA*.

Systématique, chorologie et phylogénie

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La sous-section *Jacea* [1] fut créée dans le genre *Centaurea* L. par Boissier en 1875 (sous le nom *Eujaceae*) *in Flora orientalis* (III, p. 628) pour les *C. Jacea* L., *C. amara* L., *C. nigrescens* Willd., *C. Cassia* Boiss. et *C. derventana* Vis. et Panc.; il l'opposait, dans sa section *Jacea* [2], à une sous-section *Phrygiae* [3] comprenant, entre autres espèces, *C. serotina* Bor., *C. salicifolia* M. B. et *C. Phrygia* L. Ce concept demande à peine à être amendé : les plantes désignées par Boissier sous les noms de *C. serotina* et *C. nigrescens* sont des *C. pratensis;* sous l'un comme sous l'autre vocable, la première n'est pas à sa place parmi les *Phrygiae* : elle appartient à la sous-section *Jacea*. Ainsi, les limites de la sous-section *Jacea* sont-elles parfaitement définies : avec Boissier (loc. cit.) et Briquet (9), il faut y conserver comme espèces distinctes *C. derventana* (que Gugler a incorporée à tort (12) à *C. incompta* Vis.) et *C. Cassia* (que Gugler (12) et Briquet (9) ont abaissées au rang de variétés, *in C. nigra* ou *in C. Jacea*); il faut en exclure *C. carratracensis* Wk que son créateur a placée à justite titre (*in* Flora hispanica) dans la section *Acrolophus* et *C. salicifolia* M. B. que

(1) Nom conforme aux nouvelles règles de la nomenclature.
(2) Section *Jacea* Wahlbg., Fl. suec., II (1826), 537.
(3) Sous-section *Phrygiae* Boiss., Fl. or., III (1875), 629.

Briquet (9) a rapprochée (pro var.) de *C. Jacea* et qui appartient incontestablement aux *Phrygiae* selon les vues de Boissier (loc. cit.).

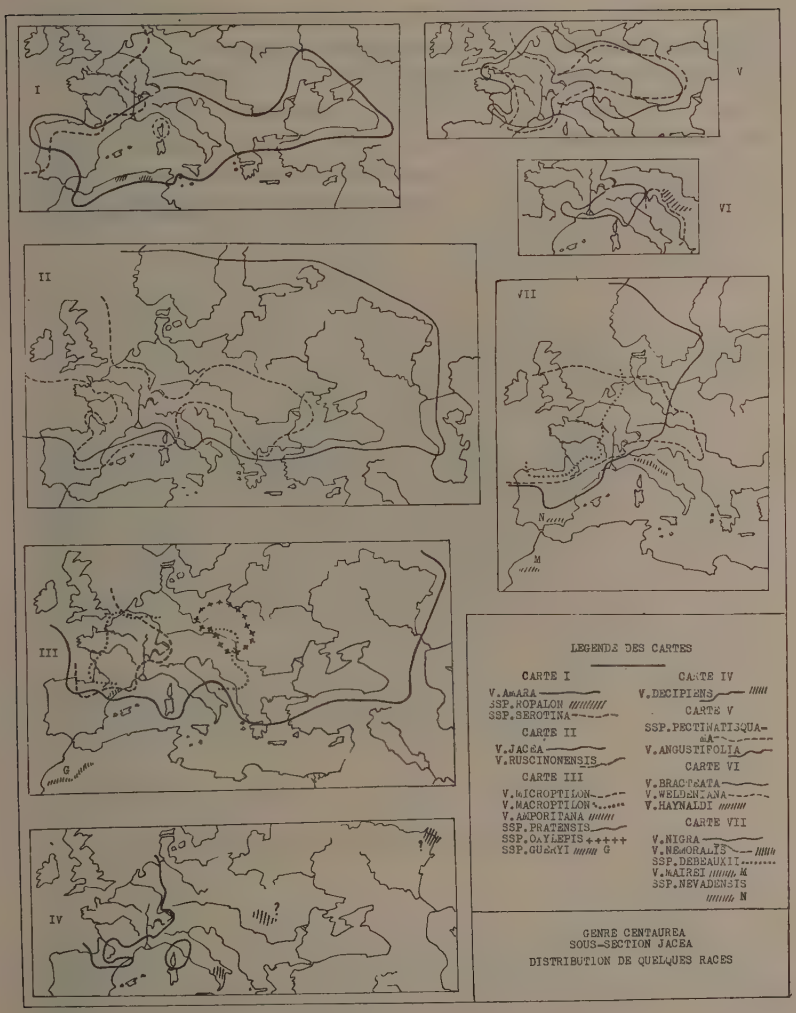
Briquet rassemblait en 1902 (9), avec rang de simples variétés non hiérarchisées, les 22 races de la sous-section en une espèce collective *C. Jacea* polymorphe à l'extrême; la systématique complexe du groupe n'y gagnait rien en clarté, bien au contraire. Briquet reconnut plus tard (1931, in Flore Alpes mar., VII) avoir fait fausse route admettant alors la notion de sous-espèce mais toujours au sein d'un unique complexe spécifique *Jacea*. Nous estimons cette concession insuffisante et nous avons toujours pensé qu'il était préférable, dans un quadruple souci de réalité objective, de vérité, de clarté et d'intérêt pratique, de s'en tenir aux vieilles conceptions linnéennes en maintenant l'autonomie spécifique des *C. Jacea*, *C. amara*, *C. nigra* de Linné, des *C. pratensis* Thuill. et *C. nigrescens* Willd., groupes parfaitement caractérisés au point de vue morphologique (organisation des calathides) ainsi que nous l'avons mis en lumière dans plusieurs études antérieures (1 à 4, 8) et au point de vue chorologique. Sur ces bases, la sous-section comporte 7 espèces distinctes : *C. Jacea*, *C. amara*, *C. pratensis*, *C. nigrescens*, *C. nigra*, *C. derventana* et *C. Cassia*. En voici les subdivisions avec leur distribution géographique :

1. **C. Jacea** L., Spec. pl., ed. 1, p. 914 (1753).

— Subsp. **Jacea.**

— — Var. **Jacea** (Eurosibérienne). — Région holarctique, de l'Atlantique à la Sibérie ouralienne; région méditerranéenne, jusqu'au Caucase et en Arménie. S'étend, en latitude jusqu'à 63° 41' N, en altitude jusqu'à 2000 m et plus (Alpes, Pyrénées, Carpathes). — Norvège. Danemark. Iles britanniques. Pays-Bas. Belgique. Presque toute la France; rare dans le Midi et la région méditerranéenne; manque dans l'Ouest. Suisse. Allemagne. Pologne. Tchécoslovaquie : Bohême, Moravie. Autriche. Hongrie. Espagne boréale, centrale et orientale : Galice, Castille, Aragon, Catalogne. Italie septentrionale (de la mer aux Alpes), Apennins jusqu'aux Abruzzes. Yougoslavie : Carniole, Croatie, Bosnie, Herzégovine. Bulgarie. Roumanie : Transylvanie, Bukovine. Russie.

— — Var. **majuscula** (Ry) J. Ar. (Orophyte). — Alpes autrichiennes et françaises. Provence, Massif Central, Vosges.



— — Var. **tomentosa** (Asch.) Ry (Subméditerranéenne). — Alpes-Maritimes d'où elle remonte çà et là vers le nord jusque dans le Dauphiné (Hautes-Alpes, Isère) et l'Auvergne (Limagne).

— — Var. **Haynaldi** (Borb.) J. Ar. (Méditerranéo-Montagnarde). — Montagnes de Croatie et de Carniole.

— Subsp. **ruscinonensis** (Boiss.) J. Ar.

— — Var. **ruscinonensis** (4) (Médio-européenne). Région holarctique méridionale, de l'Atlantique en Moravie et Transylvanie; Région méditerranéenne jusqu'en Grèce. — Iles britanniques. France : des Pyrénées à la Gironde, au Lot-et-Garonne, au Tarn-et-Garonne; des Alpes et du Jura à l'Aveyron, au Cantal, au Puy-de-Dôme et au Cher; Bassin parisien; Normandie; Est et Nord-Est; Corse. Espagne orientale et centrale. Italie septentrionale. Autriche. Hongrie. Moravie. Transylvanie. Macédoine.

— — Var. **canescens** DE NOT. (Subméditerranéenne). — Alpes-Maritimes et Provence d'où elle remonte vers le nord dans le Dauphiné (Hautes-Alpes, Isère) et jusqu'en Bourgogne (Saône-et Loire); Roussillon; Bas-Languedoc (Hérault).

— Subsp. **pectinatisquama** J. AR. (Médio-européenne). — Région holarctique moyenne, de l'Atlantique en Galicie et aux Carpathes. — Iles britanniques. France : Est et Sud-Est de l'Alsace, du Jura et des Alpes à la Région parisienne, à l'Auvergne et à l'Aude, aux Pyrénées-Orientales, à l'Ariège. Belgique : Anvers, Brabant, Liège, Namur. Allemagne jusqu'à la Silésie. Tchécoslovaquie : Bohême, Moravie. Tyrol. Hongrie. Galicie. Carpathes.

— Subsp. **carpetana** (BOISS. et REUT.) J. AR. (Méditerranéo-Montagnarde). — Espagne septentrionale et centrale. France : Basses-Pyrénées.

2. **C. amara** L., Spec. pl., ed. 2, p. 1292 (1763).

— Subsp. **amara.**

— — Var. **amara** (Subméditerranéenne). — Région holarctique méridionale d'Europe et région méditerranéenne, jusqu'en Ukraine et Arménie; Afrique septentrionale. — France : région méditerranéenne d'où elle remonte jusque dans le bassin parisien et la Belgique (Brabant, Luxembourg). Espagne : Galice, Navarre, Aragon, Castille, Catalogne, Murcie. Portugal : Minho, Beira. Suisse : Tessin, Valais. Tyrol. Italie : toute la péninsule, Sicile. Yougoslavie : Dalmatie, Serbie. Bulgarie. Grèce : Macédoine, Epire, Thessalie. Ukraine méridionale. Arménie. Maroc. Algérie. Tunisie.

(4) Inclus *C. banatica* Rochel. de Hongrie (Banat) et Transylvanie.

— — Var. **angustifolia** (Schrank) Rchb. = *C. Schrankii* Ry = *C. pannonica* Heuf. (Médio-européenne). — Région holarctique moyenne de l'Atlantique aux Carpathes. — Pays-Bas. Belgique : Hainaut, Liège, Luxembourg, Namur. France : Normandie, Bassin parisien, Bassin aquitain, Massif central, Bourgogne, Ardennes, Lorraine, Alsace. Bavière. Suisse : çà et là au nord des Alpes. Autriche : Basse Autriche, Styrie, Carinthie. Hongrie, jusqu'aux Alpes et aux Carpathes. Tchécoslovaquie : Bohême, Moravie, Slovaquie occidentale. Yougoslavie : Carniole, Croatie, Herzégovine. Transylvanie.

— — Var. **bracteata** (Scop.) DC. = *C. Gaudini* Boiss. et Reut. = *C. Timbali* M.-Don. (Méditerranéo-Montagnarde). — France : versant méridional des Alpes jusqu'en Dauphiné, en Vaucluse, en Provence et dans les Alpes-Maritimes; Cévennes méridionales jusque dans le Tarn et le Languedoc. Suisse : vallées du Valais et du Jura. Italie : Apennins, Lombardie, Tyrol, Trentin, Lucanie, Calabre, d'où elle descend dans les régions inférieures. S'élève jusqu'à 2000 m d'altitude.

— — Var. **weldeniana** (Rchb.) Briq. (Méditerranéo-montagnarde). — Italie (Istrie). Yougoslavie : Carniole, Croatie, Dalmatie et Herzégovine littorales, jusqu'en Grèce.

— — Var. **Mairei** J. Ar. (Euméditerranéenne). — Tunisie.

— Subsp. **decipiens** (Thuill.) J. Ar.

— — Var. **decipiens** = *C. Duboisii* Bor. = *C. van Haesendonckii* Thiel. et Desv. (Subatlantique). — Région holarctique occidentale d'Europe. — Danemark. Norvège. Iles britanniques. Belgique (partout). France : commune, sauf dans le Jura, les Alpes et la région méditerranéenne où elle est rare ou nulle; Corse. Représentée aussi çà et là en Espagne (Asturies, Catalogne), en Allemagne, en Suisse, en Italie (Toscane, Lucanie) et jusqu'en Transylvanie et Russie ? (Kasan) (5).

(5) La présence de cette race dans la péninsule italienne est certaine : elle y représente une irradiation atlantique relativement récente. L'existence de la même variété en Transylvanie et en Russie est très douteuse : il semble bien plutôt qu'il s'agisse dans ces régions de la sous-espèce *pratensis*.

— — Var. **Reuteri** J. Ar. = *C. gracilior* var. *semipectinata* Reut. = *C. ruscinonensis* var. *semipectinata* Ry (Orophyte sub-alpin). — France : Isère, Ain.

— Subsp. **serotina** (Bor.) J. Ar. = *C. nigra* var. *pallida* Lge = *C. fulva* Huet du Pav. = *C. rivularis* Brot. = *C. sordida* Huet du Pav. = *C. cebennica* Pourr. (Subatlantique). — Région holarctique occidentale d'Europe. — Iles britanniques. Belgique (partout). France : tout le Nord, l'Ouest et le Sud-Ouest, jusqu'en région parisienne, jusqu'au Lyonnais, au Dauphiné (Isère, Drôme, Hautes-Alpes), au haut Languedoc et à l'Ariège; Corse. Espagne (régions cantabriques). Portugal (Tras os Montes, Minho, Beira, Alto Alentejo). On a indiqué cette plante : 1) au Maroc (il s'agit de *C. pratensis* ssp. *Gueryi*); 2) à Trébizonde et en Arménie (vraisemblablement *C. pratensis*); 3) en Scandinavie (rien n'en confirme l'existence).

— Subsp. **dracunculifolia** (Duf.) J. Ar. (Euméditerranéenne). — Littoral des Pyrénées orientales et des provinces de Valence et de Catalogne.

— Subsp. **Ropalon** (Pomel) J. Ar. (Euméditerranéenne). — Algérie : Maison Carrée et la Rassauta près d'Alger, Miliana.

3. **C. pratensis** Thuill., Fl. env. Paris, p. 444 (1799).

— Subsp. **pratensis** ([6]) (Médio-européenne). — Régions holarctique et méditerranéenne d'Europe : presque toute l'Europe, dans les plaines et sur les basses montagnes, jusqu'en Transylvanie, en Russie moyenne (Kasan), sur les rivages méridionaux de la mer Noire (Bithynie, Pont) et en Arménie; manque à l'intérieur des massifs montagneux; rare ou absente en Europe méridionale. — Belgique (partout). France : partout dans les régions basses; Corse. Espagne : Asturies, Catalogne. Italie : région méditerranéenne et submontagneuse, de la Ligurie à la Vénétie, jusqu'à la Toscane et aux Abruzzes; Sardaigne. Dalmatie. Grèce : Thessalie, Phthiotide.

— Subsp. **oxylepis** (Wimm. et Grab.) J. Ar. (Médio-européenne). — Région holarctique en Europe moyenne : NW de la

([6]) Très souvent confondue avec *C. nemoralis*, ou *C. nigra*, ou plus souvent encore avec *C. nigrescens* : Espagne, Sardaigne, Grèce, Transylvanie, etc.

Bohême; Silésie; Moravie septentrionale; Hongrie septentrionale et moyenne.

— Subsp. **microptilon** (Gren.) Ry.

— — Var. **microptilon** (Subatlantique). — Région holarctique occidentale d'Europe. — Belgique (partout). Toute la France : surtout l'E, le Centre et la région parisienne; plus rare dans le Midi, le N, le NE, l'E et le SW. Suisse : Valais. Espagne septentrionale : Vieille Castille, Catalogne.

— — Var. **macroptilon** (Borb.) Ry (Médio-européenne). — Région holarctique en Europe moyenne et occidentale. Belgique : Brabant, Flandre orientale, Hainaut, Liège, Luxembourg. France : surtout l'E, le Centre, la région parisienne, l'W et le SW. Allemagne méridionale. Autriche : Styrie, Carinthie. Italie : Istrie. Hongrie occidentale. Yougoslavie : Carniole, Croatie, Bosnie, Herzégovine.

— — Var. **amporitana** Vayr. (Euméditerranéenne). — Catalogne.

— Subsp. **Gueryi** (Maire) J. Ar. (Méditerranéo-Montagnarde). — Moyen Atlas, Grand Atlas.

4. **C. nigrescens** Willd., Spec. Pl., ed. 3, p. 183 (1824).

— Subsp. **nigrescens.**

— — Var. **nigrescens** (Médio-européenne).— Région holarctique moyenne d'Europe, depuis l'Allemagne occidentale (Bade) jusqu'à la Hongrie, la Slovaquie occidentale, la Transylvanie, la Bosnie, la Bulgarie. Basse Autriche. Race planitiaire ou subplanitaire.

— — Var. **transalpina** (Schl.) Briquet (Orophyte subalpin). — Race altitudinaire holarctique qui s'étend vers le sud dans la région méditerranéenne (domaine ibérico-franco-italien) et qui descend çà et là vers le littoral ou dans les plaines. France : Alpes-Maritimes, Hautes-Alpes, Savoie, Vosges ? ; plaine française

(Aisne !, Normandie ?). Italie : versant italien des Alpes occidentales (Piémont, Tessin), Alpes lombardes, Tyrol jusqu'au Brenner, Vénétie. Suisse : Valais, Tessin, Grisons. Carinthie occidentale. Carniole.

— — Var. **rotundifolia** (Bart. et Wendl.) Briq. et Cav. (Médio-européenne). — Race monticole holarctique qui, vers le sud, déborde dans la région méditerranéenne (domaine ibérico-franco-italien et domaine balkanique) et qui descend parfois vers le littoral ou dans les plaines. France : Alpes-Maritimes jusqu'aux environs de Nice; plaine française (Normandie ?). Italie : Istrie, Alpes maritimes. Suisse : Tessin. Autriche : Styrie, Carinthie, Basse-Autriche. Hongrie occidentale. Yougoslavie : Carniole, Croatie, Moravie.

— Subsp. **neapolitana** (Boiss.) J. Ar. (Euméditerranéenne). — Italie méridionale : Marches, Abruzzes, Campanie.

5. **C. nigra** L., Spec. Pl., ed. 1, p. 911 (1753).

— Subsp. **nigra.**

— — Var. **nigra** = *C. obscura* Jord. (Subatlantique). — Domaine européo-atlantique (limite septentrionale : 64°12') jusque dans la région méditerranéenne occidentale et domaine médio-européen jusqu'en Russie moyenne et australe. — Norvège méridionale. Suède méridionale : Scanie, Blekinge. Danemark. Pays-Bas. Belgique : Brabant, Liège, Limbourg, Luxembourg. France : presque partout; rare (Languedoc, Roussillon) ou nulle (Provence) en région méditerranéenne. Suisse. Allemagne occidentale. Espagne septentrionale : de la Galice à la Catalogne et à la Castille. Italie : Alpes du Piémont et du Tessin, Apennins jusqu'aux Abruzzes (7).

— — Var. **Endressi** (Hochst. et St.) Ry (Orophyte-subalpin). — Pyrénées, Massif Central, Apennins toscans.

— — Var. **Mairei** J. Ar. (Méditerranéo-Montagnarde). — Grand Atlas.

(7) On a signalé également cette race en Transylvanie et en Russie (jusqu'en Livonie, en Ukraine et au nord de la Caspienne), toutes régions où elle fait défaut et où elle a vraisemblablement été confondue avec *C. pratensis.*

— Subsp. **nemoralis** (Jord.) J. Ar.

— — Var. **nemoralis** (Subatlantique). — Région holarctique occidentale; domaines européo-atlantique et médio-européen; rare en région méditerranéenne. — Angleterre. Belgique : Anvers, Liège, Luxembourg, Namur. France (sauf dans la région méditerranéenne). Allemagne occidentale. Suisse nord-occidentale. Bohême. Autriche : Basse Autriche, Styrie. Espagne : Galice, Asturies, région cantabrique. Italie : Alpes du Tessin, du Piémont, Bosnie ([8]).

— — Var. **pallens** Koch (Eu-atlantique). — Domaine européo-atlantique. — France : çà et là dans l'Ouest (Bretagne, Poitou, Charentes, bassin aquitain, Basses-Pyrénées).

— Subsp. **nevadensis** (Boiss. et Reut.) J. Ar. (Méditerranéo-Montagnarde). — Espagne : Sierra Nevada.

— Subsp. **Debeauxii** (G. et G.) Gugler (Eu-atlantique). — Domaine européo-atlantique. — Iles britanniques. Pays Bas ! : dunes littorales. Belgique ! : Flandre orientale. France : tout l'Ouest, des Pyrénées à la Seine-Inférieure, jusqu'en Auvergne ! et dans la région parisienne ! (Oise, Seine-et-Marne). Espagne : région cantabrique.

6. **C. derventana** Vis. et Panc. (Eu-méditerranéenne). — Macédoine boréale. Serbie occidentale. Herzégovine.

7. **C. Cassia** Boiss. (Méditerranéo-Montagnarde).— Syrie boréale.

Phylogénie

Dans le stirpe ainsi nettement délimité et analysé, les éléments les plus anciens sont ceux qui, de nos jours, croissent encore en Corse-Sardaigne, en Sicile et en Afrique septentrionale. En Corse-Sardaigne (var. *ruscinonensis*, var. *decipiens*, ssp. *serotina*, var. *pratensis*) et en Sicile (var. *amara*), ce sont les restes de lignées développées au Miocène supérieur sur la Tyrrhénide pontienne;

([8]) En Bosnie : *C. aterrima* Hayek = ! *C. nemoralis* Jord.

trois de ces races sont de nos jours relativement stables et s'opposent en cela au taxon *ruscinonensis* très polymorphe (cf. Rouy (II), p. 120) et de ce fait peut-être le moins ancien. En Afrique du Nord (var. *amara*, ssp. *amara* var. *Mairei*, ssp. *Ropalon*, ssp. *Gueryi*, ssp. *nigra* var. *Mairei*) ils appartiennent à des lignées également anciennes qui, au Mio-Pliocène (Pontien-Plaisancien) ont pu s'étendre d'Europe en Afrique par l'intermédiaire du massif bético-rifain. En Orient, certaines sippes, par la région égéique, ont pu atteindre l'Asie Mineure (Pont, Bithynie) et l'Arménie, après disparition (Sarmatien) du sillon transégéen : ssp. *pratensis*, var. *amara*.

Après un examen parallèle de ces faits d'ordre paléogéographique et chronologique, de la chorologie des races méditerranéennes ou périméditerranéennes et de leur systématique, on a l'impression que l'évolution du groupe s'est traduite très tôt, dès le Miocène supérieur, par l'individualisation, à partir d'une souche commune *Palaeo-Jacea*, de deux séries phylétiques : celle des *Palaeo-Pratenses* (9) représentant les formes à appendices ciliés et celle des *Palaeo-Vulgares* (9) correspondant aux groupes à appendices entiers ou fimbriés. Aux dépens de la seconde, celle des *Palaeo-Vulgares*, se sont différenciés la race *ruscinonensis* représentée jusqu'en Corse mais qui n'a dépassé ni l'Espagne centrale et orientale ni l'Italie septentrionale et un type *Palaeo-amara* à distribution bien plus large et plus méridionale, européo-africaine. Seuls les types archaïques hypothétiques *Palaeo-amara* et *Palaeo-pratensis* se sont étendus à l'Afrique du Nord, par l'ouest, au Pontien-Plaisancien; ils ont évolué de façon différente en Europe et en Afrique. Le premier, *Palaeo-amara*, a donné : 1° une race panméditerranéenne : var. *amara;* 2° en Europe, les races *decipiens* et *serotina* passées en Corse au Pontien ; 3° en Afrique, postérieurement à la disjonction bético-rifaine, les races planitiaires *Ropalon* et ssp. *amara* var. *Mairei;* le second, *Palaeo-pratensis*, a fourni : 1° en Europe, les races *pratensis* (passée en Corse au Pontien) et *nigra* (restée continentale); 2° au Maroc, après la formation de Gibraltar, deux races altitudinaires : ssp. *Gueryi* et ssp. *nigra* var. *Mairei*.

Une telle évolution, certainement préastienne, se justifie parfaitement par la répartition actuelle de la sous-section *Jacea* en Méditerranée occidentale. Elle explique : 1° la discordance actuelle des taxa entre la péninsule ibérique *(carpetana, dracunculifolia, ampo-*

(9) Des noms proposés par Hayek (10) pour 2 sous-sections.

ritana, nevadensis) et l'Afrique où sont localisées les endémiques *amara-Mairei, pratensis-Gueryi, nigra-Mairei, Ropalon;* 2° le caractère relictuel de la sous-section en Espagne-Portugal et en Afrique septentrionale où la sporadicité et le micro-endémisme sont les caractères essentiels des distributions.

A partir du Plaisancien, les connexions intercontinentales disparaissant en Méditerranée occidentale, l'évolution de la sous-section se poursuit autonome dans les deux parties dispointes de son aire; en Europe, de nombreuses races s'individualisent sous l'influence conjuguée du climat et de l'orographie : atlantiques, médio-européennes, orophytes subalpins, méditerranéennes (planitiaires ou montagnardes); de nombreuses lignées de transition créent une étroite interdépendance entre toutes ces races dont aucune n'a passé la Méditerranée.

C. nigra, dans son ensemble, est sous la dépendance du type *Palaeo-pratensis;* il en est de même pour *C. pratensis,* à l'exception toutefois de la var. *macroptilon* plus visiblement apparentée à la sous-espèce *pectinatisquama* (en raison à la fois de sa morphologie appendiculaire et des caractères de ses feuilles florales). *C. Jacea* est subordonnée au type *ruscinonensis* et *C. amara,* au type *Palaeo-amara.* La filiation de *C. nigrescens* à ce dernier semble moins évidente; bien que cette espèce possède toujours des appendices ciliés (brièvement), on n'a signalé que rarement des lignées de transition non hybrides l'unissant à *C. pratensis* (*C. gradata* Ry (11)), types intermédiaires d'ailleurs fort peu répandus. Par contre, il existe entre *C. nigrescens* (s.l.) et les 3 sous-espèces de *C. amara* des connexions nombreuses et très répandues dont nous avons fait antérieurement (1) dans les groupes *amara, decipiens, serotina,* des micromorphes « *parvisquama* » et « *subparvisquama* » mais que Gugler a rattachées (12) sous d'autres noms (in ssp. *regularis*) au *C. nigrescens.* C'est l'existence de ces transitions multiples et fréquentes entre les 2 groupes spécifiques qui nous a conduit à subordonner en définitive *C. nigrescens* au type *Palaeo-amara.* Notre tableau résume cet ensemble de conceptions qui, pour conclure, donnent lieu aux remarques suivantes.

Il est impossible de considérer la sous-espèce *Jacea* comme type ancestral des *Jacea;* bien que ce taxon soit de nos jours le plus largement distribué (Eurosibérien), il manque en Corse, en Sardaigne, en Sicile et en Afrique du Nord, ce qui oblige à lui attribuer une origine relativement récente, les groupes *ruscinonensis, amara, decipiens, serotina, pratensis* et *nigra* représentés dans ces régions

constituant les types archaïques de la sous-section : il manque hors de l'Europe continentale et son individualisation de ce fait doit être postérieure à la dislocation de la Tyrrhénide pontienne.

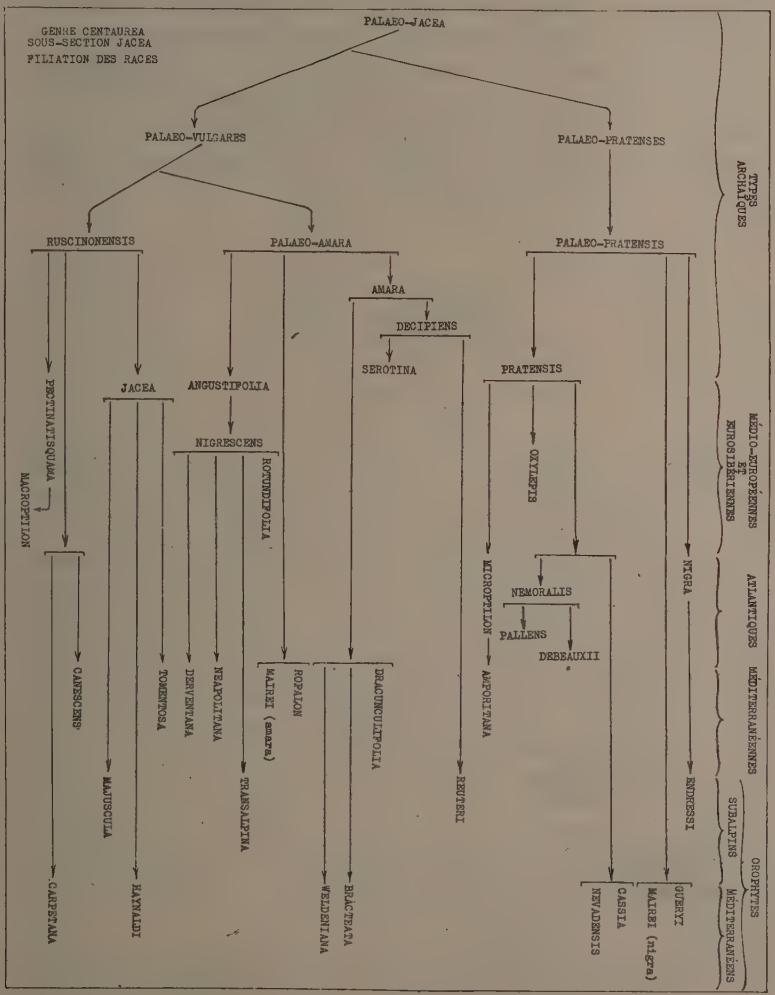
Au point de vue géographique, la sous-section doit être d'origine périmésogéenne septentrionale; elle est devenue périméditerranéenne — surtout occidentale — par son évolution mio-pliocène; son caractère paneuropéen puis eurasiatique ne s'est affirmé que depuis le Plaisancien par l'apparition de races multiples planitiaires ou altitudinaires dans les domaines européo-atlantique, médio-européen et méditerranéen.

Heer a bien étudié et figuré (in Flora tertiaria Helvetiae, III, p. 2 et pl. CI, 1859) divers akènes de Composées mais s'il est certain d'après ces documents que les *Carduacées* dont les *Cirsium* ! participaient à la flore d'Oeningen, le genre *Centaurea* y fait défaut. Il manque encore : 1° dans les flores du Miocène supérieur : Plaisancien de Francfort, de Reuver; Astien de Castle Eden, où cependant on a identifié des semences de Composées (*Crepis, Carduus, Inula, Pulicaria,* etc.); 2° dans le Villafranchien de Tegelen où l'on note des *Carduus, Cirsium, Bidens.* Les restes les plus anciens que l'on en connaisse sont du Plaisancien de Kroscienko (Pologne), dans des couches contemporaines de celles de Reuver, présence qui renforce l'opinion que nous avons émise plus haut à propos du caractère paneuropéen et eurasiatique tardif (Pliocène) de la sous-section. L'existence du genre se trouve ultérieurement confirmée aux époques « chaudes » du Quaternaire (préglaciaire, interglaciaire ou postglaciaire); en Angleterre (Norfolk, Suffolk), on l'a identifié, et plus particulièrement *C. nigra,* dans le Quaternaire ancien avec des *Arctium, Carduus, Cirsium.*

Les caractères de la sous-section s'opposent dans les 2 parties de son aire. Au sud de la Méditerranée, les races sont à une près des micro-endémiques, sont peu nombreuses, sans lignées intermédiaires, ce qui traduit bien leur caractère ancien et relictuel; en Europe au contraire, elles sont multiples, interdépendantes par d'innombrables connexions, réalisant les caractéristiques des groupes jeunes et encore en pleine évolution; elles n'y sont que partiellement relictuelles.

Quoique beaucoup plus simple, le problème se pose et se résout de façon similaire pour l'autre sous-section des *Jacea,* la sous-section *Phrygiae.* Briquet a tracé les grandes lignes de son évolution en 1902 (9). Toutefois, il ignorait à cette époque l'existence dans le Rif de la sous-espèce *Ali-beyana* du *C. uniflora.* Aujourd'hui,

cette autre sous-section est représentée en Espagne par *C. pectinata*, en Italie par *C. procumbens*, *C. pectinata*, *C. uniflora* (prol. plur.), *C. Phrygia*, en Corse par *C. procumbens*, en Afrique du Nord par *C. uniflora* ssp. *Ali-beyana*. Elle a subi depuis le Miocène supérieur une évolution parallèle à celle de la sous-section *Jacea*, avec 1 espèce commune à l'Europe continentale et à la Corse, *C. procumbens*, 1 autre commune à l'Europe continentale et à l'Afrique du Nord, *C. uniflora ;* la *sous-espèce Ali-beyana* du *C. uniflora* représente



au Maroc une race relictuelle homologue dans le *C. uniflora* (sous-section *Phrygiae*) de la sous-espèce *Gueryi* du *C. pratensis* et de la var. *Mairei* du *C. nigra* (sous-section *Jacea*), au quadruple point de vue géographique, écologique, systématique et phylogénique.

Quelles que soient les lignées méditerranéennes que l'on considère chez les *Carduacées* (in extenso) (5, 6, 7) c'est toujours au Mio-Pliocène que ramènent les nécessités imposées en Méditerranée occidentale par le développement des lignées entre l'Europe et l'Afrique. Période géocratique, c'est la seule qui ait pu permettre de multiples échanges floristiques transméditerranéens, à l'ouest, par Gibraltar, entre l'Afrique du Nord et l'Espagne, au centre, à travers la Tyrrhénide pontienne, entre l'Europe continentale et la Corse-Sardaigne, à l'est, par la péninsule italique, entre l'Italie continentale et la Sicile, en Orient enfin, par les isthmes égéiques, entre l'Asie Mineure et les Balkans, et, par ces derniers, avec les grandes plaines eurasiatiques.

Bibliographie sommaire.

FLORE ACTUELLE.

1. Arènes J., Les Centaurées de la sous-section *Eu Jaceae* Boiss., *Bull. Cynar. Fr.*, IV (1938-1939).
2. — , Les races françaises de la sous-section *Eu Jaceae* Boiss. du genre *Centaurea*, *Bull. Soc. fr. Ech. Pl. vasc.*, I (1947).
3. — , Les *Centaurea* hybrides de l'Herbier du Muséum d'Histoire Naturelle, *Ibid.*, II (1948) et III (1949).
4. — , La section *Jacea* Wahlbg du genre *Centaurea* L. en Afrique du Nord, *Mém. hors-sér. Soc. Hist. Nat. Afr. N.*, II (1949).
5. — , Monographie du genre *Arctium* L., *Bull. Jard. bot. État Brux.*, II (1950).
6. — , A propos des connexions ibérico-marocaines et siculo-tunisiennes, *C. R. som. Séances Soc. Biogéogr.*, 247 (1951).
7. — , Le groupe spécifique du *C. paniculata* L. sensu latissimo, *Mém. Mus. Nat. Hist. Nat.*, sér. B, Bot., I (1951).
8. — , Les Composées-Cynarocéphales de Belgique, *Bull. Jard. bot. État Brux.*, XXIV (1954).
9. Briquet J., Monographie des Centaurées des Alpes Maritimes (1902).
10. Hayek A. von, Die Centaureen-Arten Osterreich-Ungarns, *Denks. Mat. Nat. Cl. K. Ak. Wiss.*, LXXII (1901).
11. Rouy G., Flore de France, XI (1905).
12. Gugler W., Die Centaureen des Ungarischen Nationalmuseums, *Ann. Mus. Nat. Hung.*, VI (1907).

FLORE FOSSILE

13. Mädler K., Die Pliozäneflora von Frankfurt am Main, *Abh. d. Senk. Nat. Gesell.*, Abh. 446 (1939).

14. Reid E. M., A comparative Review of Pliocene Floras, based on the Study of fossil Seeds, *Quarterly Journ. of the Geological Soc.*, 76 (1920).
14. Reid E. M. et Chandler M. E. J., The fossil flora of Clacton-on-Sea, Ibid., 79 (1923).

15. Reid Cl. et Reid E. M., On the Pre-Glacial Flora of Britain, *Journ. Linn. Soc. Bot.*, XXXVIII (1908).

16. Szafer Wl., Flora pliocenska z'Kroscienka u Dunajcem, *Rozpr. Wydz. Matem.-Przyrodn*, 72, Dz B, 1-2 (1946).

LES LATHRAEOCARPÉES, TRIBU NOUVELLE DES RUBIOÏDÉES (Rubiacées)

PAR

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La collection d'échantillons d'herbier provisoirement placés dans le genre *Triainolepis* Hook. f., que j'avais reçue du Laboratoire de Phanérogamie du Muséum National d'Histoire Naturelle de Paris, et qui m'a servi pour ma monographie des Triainolépidées (1) contenait aussi quelques échantillons qui ne pouvaient pas appartenir à cette tribu. Quoique montrant, par leur port et aussi par leurs drupes munies d'une pyrène pluriloculaire, une ressemblance assez frappante avec le *Paratriaina xerophila* Brem., un des représentants des Triainolépidées, ils se distinguaient de tous les membres de cette tribu par leur feuilles ternées dont les parties basales sont liées l'une à l'autre par des stipules tronquées, par le dédoublement des lobes du calice, par les étamines incluses et surtout par les grains de pollen munis de plusieurs fissures au lieu de trois et par les ovules solitaires au lieu de collatéraux. Il parut que ces échantillons aberrants appartenaient à deux espèces qui se distinguaient l'une de l'autre par la forme des feuilles et des lobes du calice, par la présence ou l'absence de poils dans le tube de la corolle et par la structure du péricarpe, mais que, comme elles se ressemblaient dans tous les caractères essentiels, il fallait les placer dans le même genre. L'ovaire est dans ce genre entièrement caché

(1) Bremekamp, C. E. B., Monographie des Triainolépidées, tribu nouvelle des Rubioidées (Rubiacées), *Proc. Kon. Ned. Akad. Wetensch.*, Ser. C, LIX, pp. 1-21, 2 fig. (1956).

dans la gaine folio-stipulaire; au moment où le fruit est mûr, cette gaine se fend; à cause de cette position peu commune du fruit, je propose pour ce genre nouveau le nom *Lathraeocarpa*.

La présence de raphides prouve que ce genre appartient à la sous-famille des Rubioidées (²); par la préfloraison valvaire et les ovules solitaires, il montre son affinité avec les Knoxiées, les Psychotriées, les Coussarées, les Gaertnerées, les Morindées, les Paedériées, les Spermacocées, les Anthospermées et les Rubiées. Avant de discuter sa position dans ce groupe de tribus, il me semble désirable de donner une description du genre et de ses deux espèces.

Lathraeocarpa BREM. gen. nov.

Fruticuli ramosiores, ex axillis foliorum ramorum principalium ramulos abbreviatos foliis minoribus instructos emittentes. *Folia* fere omnia ternata, sessilia, parva et angusta, margine valde revoluta, nervis inconspicuis. *Stipulae* truncatae, in apiculos 1 vel 2 productae, per longitudinem totam cum basibus foliorum connatae, intus glabrae. *Flores* solitarii, ramulos abbreviatos terminantes, subsessiles, hermaphroditi. *Ovarium* in vagina stipulari foliorum supremorum absconditum, 4-loculare; ovula quoque loculo solitaria, funiculo satis longo, e parte basali axis ascendente instructa. *Calyx* usque ad basin partitus; lobi 8 in spinulam brevem exeuntes. *Corolla* tubiformis 4-mera, alba, tubo tereti orem versus dilatato, extus pubescente, lobis tubo brevioribus. *Stamina* in parte dilatata tubi inserta, inclusa; filamenta glabra; antherae dorsifixae linearioblongae vel oblongae, utroque extremo obtusae. *Granula pollinis* subglobosa, pluri-colporata. *Discus* annularis glaber. *Stylus* glaber, exsertus, in stigmata 4 filiformia exeuns. *Fructus* drupa monopyrena; pyrena ossea, 4-locularis. *Semina* albuminosa; albumen carnosum; embryo axilis, teres, cotyledonibus angustis et radicula infera instructus.

Genus speciebus adhuc notis duabus in Madagascari endemicum.

Species typica : *L. Decaryi* BREM. spec. nov. v. infra.

1. **Lathraeocarpa Decaryi** BREM. spec. nov., a *L. aciculari* BREM. v. infra foliis linearibus, calycis lobis deltoideis, corollae tubo intus

(²) BREMEKAMP, C. E. B., Les sous-familles et les tribus des Rubiacées, *Huit. Congrès Intern. Bot., Rapp. Comm. Avant Congrès*, Sect. 2, 4, 5 et 6, pp. 113-114 (1954).

glabro, drupa majore et vinculis albidis cum sulcis alternantibus instructa distinguenda.

Triainolepis Decaryi A. M. Homolle in sched.

Fruticulus 1,2 m altus vel altior. *Rami* novelli dense pubescentes, 0,6-1,0 mm diam., internodiis 1-1,5 cm longis; veteriores cortice griseo-brunneo opaco vestiti. *Folia* omnia ternata vel aliquae opposita, linearia, ramorum principalium 6-12 mm longa et 0,8-1,6 mm lata, ramulorum abbreviatorum paulo minora, omnia apice acuta et breviter spinosa, basi angustata, utrimque densius pubescentia, costa subtus albida et prominente. *Vagina* stipularis circ. 1 mm alta, extus dense pubescens. *Ovarium* dense pubescens, 8-sulcatum. *Calycis* lobi deltoidei, 1,2 mm longi, glabri, dorso convexi. *Corolla* tubo 7 mm longo, ad medium 0,6 mm diam., parte superiore usque ad 1,5 mm dilatato, intus glabro, lobis 2,0 mm longis, extus sparse pubescentibus. *Stamina* filamentis 0,3 mm longis et antheris lineari-oblongis 1,2 mm longis instructa. *Granula pollinis* 8-usque ad 10-colporata, 37 μ diam. *Stylus* 10 mm longus; stigmata 1,6 mm longa, contorta. *Drupa* 8-sulcata, sulcis cum vinculis albidis alternantibus, 3,5 mm diam.

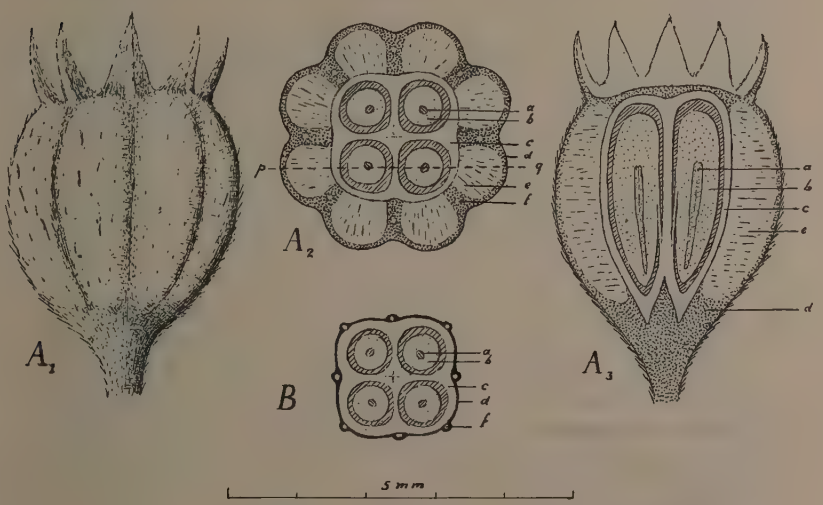

Fig. 5. — *Lathraeocarpa Decaryi* Brem. : A_1, drupe ; A_2, coupe transversale ; A_3, coupe longitudinale. — *L. acicularis* Brem. : B, coupe transversale. (a, embryon; b, albumen; c, pyrène; d, chlorenchyme; e, cordon; f, fibre vasculaire; p-q, ligne indiquant la position de la coupe longitudnale).

Habitat Madagascaris partem austro-orientalem.

MADAGASCAR : Sud-Est : Ambovombe, 18-6-1924, *Decary* 2803 (holotype P); ibid., 2-2-1931, *Decary* 8457; ibid, 9-12-1931, *Decary* 9508.

Observation. — La drupe du *Lathraeocarpa Decaryi* (Fig. 5, A) rappelle celles qu'on trouve chez quelques espèces de *Triainolepis*, notamment chez *Tr. Fryeri* (HEMSL.) BREM. et *Tr. africana* HOOK. F. ([3]), où il y a aussi un cercle d'épaississements en forme de cordons s'étendant de la base au sommet, mais tandis que chez ces espèces de *Triainolepis* le nombre des cordons correspond au nombre des loges ovariennes, il est dans la drupe du *Lathraeocarpa Decaryi* deux fois plus grand. Chez *L. Decaryi* ces cordons sont formés de cellules aux parois assez minces, et remplies d'air; à cause de cela, les drupes ont une flottabilité très marquée, ce qui pourrait aider à leur dispersion. Ces cordons manquent chez *L. acicularis* (Fig. 5, B).

2. **Lathraeocarpa acicularis** BREM. spec. nov., a *L. Decaryi* BREM. foliis acicularibus, calycis lobis ovatis et valde inaequalibus, corolla tubo intus piloso, drupa minore, vinculis carente sed distincte costata distinguenda.

Fruticulus. Rami novelli dense puberulo-pubescentes, 0,6-0,8 mm diam., internodiis 0,7-1,0 cm longis; veteriores cortice griseo opaco vestiti. *Folia* ternata, acicularia, ramorum principalium 12-14 mm longa et 0,4-0,6 mm lata, ramulorum abbreviatorum dimidio breviora, omnia apice acuta et mucronata, basi vix angustata, utrimque puberula vel folia aliquae subglabra, costa subtus prominula, colore haud conspicua. *Vagina* stipularis circ. 1 mm alta, extus pubescens. *Ovarium* subglabrum, vix notabile sulcatum. *Calycis* lobi ovati, valde inaequales, 0,3-0,6 mm longi, margine ciliati, dorso plani. *Corolla* tubo 6 mm longo, ad medium 0,7 mm diam., parte superiore usque ad 1,7 mm dilatato, intus densius pilosi, lobis 2,2 mm longis, extus glabris. *Stamina* filamentis 0,3 mm longis et antheris oblongis 0,5 mm longis instructa. *Granula pollinis* 8-colporata, 30 μ diam. *Stylus* 8,5 mm longus; stigmata 0,7 mm longa. *Drupa* 8-costata, 2 mm diam.

Habitat Madagascaris partem austro-occidentalem.

([3]) Cfr. BREMEKAMP, C. E. B., *Proc. Kon. Ned. Akad. Wetensch.*, ser. C, LIX, p. 5, fig. 1d et 1f (1956).

Madagascar : Sud-Ouest : Tuléar, dunes de Befanamy, 15-2-1921, *Poisson* 2e voy. 144 (holotype P).

Observation. — Les trois échantillons de *Lathraeocarpa Decaryi* et l'échantillon unique de *L. acicularis* montrent le même type de fleur; dans tous les quatre, les étamines sont incluses et le style longuement exsert. Les fleurs sont donc probablement isomorphes, et cela constituerait une autre différence avec les Triainolepidées, où chaque espèce se présente sous deux formes, une forme brachystyle et une forme dolichostyle.

* * *

Les caractères de *Lathraecarpa* qui distinguent ce genre des Triainolépidées sont déjà énumérés ci-dessus. Les ovules solitaires — au lieu de collatéraux — et les grains de pollen munis de plusieurs fissures sont ici sans doute de première importance, mais la forme tout à fait différente des stipules, le dédoublement du nombre des lobes calicinaux et les étamines entièrement incluses méritent aussi notre attention, surtout parce qu'ils pourront nous aider à déterminer sa position dans le groupe de tribus possédant des ovules solitaires et une préfloraison valvaire des lobes de la corolle, c'est-à-dire dans le groupe formé par les Knoxiées, les Psychotriées, les Coussarées, les Gaertnerées, les Morindées, les Paedériées, les Anthospermées, les Spermacocées et les Rubiées.

Quelques-unes de ces tribus peuvent être éliminées sans plus. La tribu des Knoxiées peut être écartée à cause de la position pendante des ovules et de la radicule infère; notre genre en diffère de plus par le port, la structure des stipules, les fleurs solitaires, les étamines incluses et la pyrène quadriloculaire. Les Spermacocées diffèrent de *Lathraeocarpa* par leurs ovules attachés au milieu du dissépiment, par leurs fruits capsulaires ou dicoques et par la structure des grains de pollen qui ressemblent à ceux de notre genre par la présence de plusieurs fissures (colpae), mais en diffèrent par l'absence de pores. Les Rubiées, qui par la structure du pollen s'approchent des Spermacocées, se distinguent de *Lathraeocarpa* en outre par l'absence de stipules, par l'albumen corné et l'embryon arqué. Dans les autres tribus, les ovules sont, comme chez *Lathraeocarpa*, insérés dans l'angle interne de la loge ovarienne près de

sa base. Parmi ces tribus les Psychotriées, les Coussarées, les Gaertnerées et les Morindées se distinguent de notre genre par l'albumen corné de leurs graines; les Coussarées, en outre à cause de leur ovaire uniloculaire ou partagé en deux par une paroi très mince et leur fruit contenant une seule graine, et par la structure de leurs stipules plus ou moins libres; les Gaertnerées, par leur drupes supères et par leur stipules unies en une longue gaine laciniée. De toutes ces tribus, le genre *Lathraeocarpa* se distingue en outre par sa pyrène quadriloculaire, par ses stipules unies sur toute leur longueur avec la partie basale des feuilles, et par le dédoublement du nombre des lobes calicinaux. Les seules tribus donc qui nous restent à considérer sont les Paedériées et les Anthospermées, toutes deux encore très mal délimitées et à cause de cela très difficiles à juger.

Parmi les Paedériées, *Hamiltonia* Roxb. et *Leptodermis* Wall., deux genres très voisins l'un de l'autre, ressemblent à *Lathraeocarpa* par leur port, par leurs étamines incluses et leur style exsert, et par l'ovaire quadriloculaire; leurs grains de pollen munis de quatre fissures (colpae) méritent aussi notre attention. Le genre *Lathraeocarpa* néanmoins se distingue d'eux par ses stipules entièrement différentes, ses fleurs tétramères munies d'un calice octomère et sa pyrène quadriloculaire. De plus, le péricarpe du fruit de *Hamiltonia* et de *Leptodermis* consiste en une couche extérieure qui s'ouvre en cinq valves et une couche intérieure qui enveloppe la graine comme une sorte de sac réticulé; rien de cela ne se trouve chez *Lathraeocarpa*. On peut douter que l'affinité des genres *Hamiltonia* et *Leptodermis* avec *Paederia* L. soit suffisamment prononcée pour justifier leur inclusion dans la même tribu, mais ces genres ne peuvent certainement pas être considérés comme proches parents de *Lathraeocarpa*.

Les Anthospermées possèdent, comme le genre *Lathraeocarpa*, des graines munies d'un albumen charnu, et on trouve dans cette tribu quelques genres qui lui ressemblent par leur port. Ils s'en distinguent cependant par leur étamines exsertes et la plupart des Anthospermées s'éloignent en outre de notre genre par leurs fleurs unisexuées et leur fruits capsulaires ou dicoques. Le genre qui lui ressemble le plus est probablement *Coprosma* Forst., dont l'ovaire est quelquefois quadriloculaire et dont le fruit est une drupe, quoique celle-ci ne soit jamais munie d'une pyrène quadriloculaire. Cependant ni *Coprosma* ni aucun autre genre appartenant à cette

tribu ne peut être considéré comme un proche parent de *Lathraeocarpa*.

Comme il n'y a donc pas de place pour le genre *Lathraeocarpa* dans aucune des tribus qu'on a reconnues jusqu'ici dans les Rubioidées, il faut créer pour lui une tribu nouvelle. Cette tribu peut être décrite dans les termes suivants :

Lathraeocarpeae Brem. tribus nova *Rubioidearum* pyrena pluriloculari cum *Triainolepideis* congruens, sed ovulis quoque loculo solitariis et granulis pollinis pluricolporatis ab eis diversa, a tribibus ovulis quoque loculo solitariis instructis stipulis per longitudinem totam cum basibus foliorum vicinorum connatis, numero loborum calycinorum duplicato, pyrena quadriloculari diversa, ovulis e septi parte basali ascendentibus et radicula infera a *Knoxieis*, albumine carnoso a *Psychotrieis*, *Coussareis*, *Gaertnereis*, *Morindeis*, *Spermacoceis* et *Rubieis* distinguenda.

Fruticuli ramosiores, ex axillis foliorum ramorum principalium brachyblastos emittentes. *Folia* fere omnia ternata, sessilia, parva et angusta. *Stipulae* truncatae, ad margines laterales cum parte basali foliorum vicinorum connatae, inter folia in apiculos 1 vel 2 productae. *Flores* solitarii brachyblastos terminantes, hermaphroditi. *Ovarium* in vagina stipulari foliorum supremorum absconditum, 4-loculare; ovula quoque loculo solitaria, erecta, anatropa, dorso funiculo satis longo e parte basali axis ascendente instructa; micropyle extrorsum infera. *Calyx* usque ad basin in lobos 8 partitus. *Corolla* tubiformis, 4-mera, tubo tereti orem versus dilatato, lobis valvatis tubo brevioribus. *Stamina* in parte dilatata tubi inserta, inclusa; antherae dorsifixae. *Granula pollinis* pluri-colporata. *Discus* annularis. *Stylus* exsertus in stigmata 4 filiformia exeuns. *Fructus* drupa monopyrena; pyrena ossea 4-locularis. *Semina* albuminosa; albumen carnosum; embryo axilis, teres, cotyledonibus angustis et radicula infera instructus.

Tribus adhuc ad genus singulum in Madagascari endemicum constricta.

Summary.

A new genus *Lathraeocarpa* is created for two new species from Madagascar. In its plurilocular ovary it resembles the genera *Triainolepis* Hook. f. and *Paratriaina* Brem., but it differs from them in the solitary instead of collateral

ovules and in the pluricolporate pollen grains. The presence of raphides proves that it belongs to the subfamily *Rubioideae*, but as there appeared to be no room for it in any of the tribes with a single ovule per ovary cell and with valvate aestivation of the corolla lobes, a new tribe had to be created for it. This tribe, the *Lathraeocarpeae*, differs from the other ones in the nature of the stipules which are united along their whole length with the basal part of the leaves and in the doubling of the number of calyx lobes, and from all of them, the *Triainolepideae* excepted, in the plurilocular pyrene.

Botanisch Museum, Utrecht,
février 1957.

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